Fire Management notes

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Firefighter Safety & Health

United States Department of Agriculture
Forest Service

Video Statement on Firefighter Safety

Dan Glickman

Editor's Note: *The following comments from Agriculture Secretary Glickman were broadcast in a video shown at the National Firefighter Safety Workshop in Snowbird, UT, in May 1995. The objectives of this workshop, sponsored by the National Wildfire Coordinating Group, were to show management's commitment to firefighter safety, to share information on current firefighter safety projects and initiatives, and to establish a closer working relationship between firefighters and management. For further information about the conference, see "National Workshop Focuses on Firefighter Safety" by David Aldrich on page 4 of this issue.*

Rod Flynn, wildlife biologist with the Alaska Department of Fish and Game, and Agriculture Secretary Dan Glickman discuss the importance of ecosystem management on the Lemon Creek Trail in the Tongass National Forest just outside Juneau, AK. Photo: Bob Nichols, USDA Forest Service, Washington, DC, 1995.

Hello, I'm Dan Glickman, Secretary of Agriculture. I am not an expert in wildfires or in fire safety. But, since I took this job, I have been learning as much as I can. One thing I definitely do know is how valuable all our firefighters are to their families, the interagency fire community, and to the entire Nation. Attention to safety and the new "Code of Conduct for Safe Practices" will strengthen our commitment to firefighter safety. These rules are critical to safety on the fireline.

I want to thank you for your successful efforts during the past fire season and for your continued attention and diligence to safety in your day-to-day operation—for your sake and those you protect.

I know 1994 was a tragic year. However, we need to remember the many lives that were saved, the homes that remain standing, and the millions of acres of land that remain diverse, productive, and sustainable.

Your agency leaders need to hear from you about promoting safe fire operations. This workshop is an important forum for sharing your concerns and ideas. You must always challenge and ask yourselves what can be done to make your job safer and what you can do to ensure the safest working environment for those around you. These are the questions I hope you discuss and answer at this workshop.

You folks are the finest firefighters in the world. I know of your dedication. I also know you will dedicate yourselves to safety.

Have a safe and successful season. ■

Dan Glickman is the Secretary of the United States Department of Agriculture, Washington, DC.

This issue of *Fire Management Notes* (FMN) is the second of two focusing on the safety and health of wildland firefighters. The other issue was FMN 55(3). Many thanks to all who contributed information, shared their experiences with the fire community, and gave advice during the editorial process.

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On the Cover:

In briefings such as this one, Incident Commanders promote firefighter safety by communicating information on such aspects of the wildfire incident as weather, terrain, safety zones, and escape routes. Photo: USDA Forest Service, Washington, DC, 1992.

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National Workshop Focuses on Firefighter Safety

David Aldrich

Firefighter safety has received unprecedented national focus and attention since the tragic 1994 fire season. Reviews ranging in scope from national, interagency policy to management of individual fires have produced a dizzying number of action items, all directed toward safer fire operations.

Even though the welfare of firefighters was at the heart of all the reviews, one event in 1995—the National Firefighter Safety Workshop sponsored by the National Wildfire Coordinating Group (NWCG)—brought 200 firefighters from all areas of the wildland fire community together in Snowbird, UT, on May 23 and 24 to discuss their safety. The firefighters had the opportunity to talk to and hear from top-level management representing the U.S. Departments of Agriculture and Interior, the National Association of State Foresters, and wildland fire agencies. In addition, the workshop—with the theme "Safety Comes First, on Every Fire, Every Time"—provided an opportunity for free-flowing communications among firefighters.

Since it was not possible for all wildland firefighters to attend the workshop, each geographic area of the United States sent individuals who represented that area's diversity of firefighters and agencies.

Dave "Shag" Aldrich is the branch chief for Ground Operations Safety, USDA Forest Service, Fire and Aviation Management, Boise, ID.

Agency leaders Dave Unger, USDA Forest Service (top left), and Claudia Schechter, U.S. Department of the Interior (bottom right), listen while firefighters voice their concerns about safety. Photos: James Stone, USDA Forest Service, Intermountain Region, Ogden, UT, 1995.

Management had the following three goals at the workshop:

- To convey clearly that firefighter safety is the highest priority in all fire operations, that it is not conditional nor is it negotiable.
- To listen to firefighter issues, concerns, and proposals and to respond immediately, if possible. When management cannot respond quickly, to develop a mechanism to respond later,

thus forging closer working relationships between firefighters and management.
- To share information about current firefighter safety projects and initiatives.

During the 2 days of intense dialogue, participants thoroughly covered fire programs, both in general sessions and concurrent breakout sessions. The "Executive Summary" for the proceedings of the workshop (NWCG 1995) concluded that there were three key "concepts" that emerged from the discussions: **accountability, communications, and individual qualifications.** In addition, workshop participants were concerned about the impacts of current and future **budgets**, **organizations**, and **staffing**. The "Executive Summary" gave the following findings of each issue:

- **Accountability**—Firefighters expect to be held individually accountable and need to feel confident that managers at all levels are accountable as well.
- **Communications**—Firefighters would like management to clearly identify effective procedures or communication methods that will allow them to:
  1) get clarification of orders which they feel compromise safety, without fear of reprisal;
  2) have an opportunity to raise safety issues, concerns, or questions during day-to-day or routine operations including knowing [who are] the appropriate contacts in management that can respond in a timely manner; and
  3) receive needed safety messages in a timely manner when they are out in the field or on fire assignments.
- **Qualifications, Budgets, Organization, and Staffing**—Firefighters are concerned that downsizing and restructuring [are] creating vacancies that are not being filled in a timely manner; and that the replacement pool of qualified persons for key positions is inadequate due to the high rate of loss of experienced personnel. The ultimate consequence is the compromising of firefighter safety (NWCG 1995).

Representatives from each geographic area developed a plan for taking the workshop information back to the firefighters they represented so that they can begin working on the issues and concerns identified during the workshop.

The proceedings of the workshop were published and distributed during June 1995. If you have not seen a copy, contact your local geographic area chairperson. Those with access to the Forest Service's Data General system can get an electronic copy on QUIX. For more information about the workshop or wildland firefighter safety on the ground, contact Dave Aldrich at the National Interagency Fire Center, 3833 South Development Ave., Boise, ID 83705, or telephone him at 208-387-5102.

Literature Cited

National Wildfire Coordinating Group. 1995. Proceedings of the NWCG Firefighter Workshop, May 23-24, Snowbird, Utah. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 118 p. ■

Return Fire to Its Place in the West[1]

Bruce Babbitt

North of Interstate 70 in the Colorado Rockies rise the slopes of Storm King Mountain. There, at 4 p.m. on July 6, 1994, a 300 foot (91 m) wall of flame swept uphill, taking the lives of 14 firefighters. The fire was not in redwood, pine, or cedar forests; it burned in shrubland of pinyon-juniper and Gambel oak.

From Mexico to the Canadian border, scrub trees such as these are taking over. Junipers advance across lowland plains; doghair thickets of ponderosa fill gaps in the highland forests; spruce and fir crowd out aspen groves. In arid lands, these trees take what little water is available, creating a tinder box of fuel.

What Has Caused This Change?

Why are our western forests and rangelands changing so dramatically? Because we have systematically removed natural fires. We have eliminated the frequent, light-burning fire cycles that used to thin the forests of young trees, kill off the spreading juniper seedlings, and hold brush in check.

The naturalist Aldo Leopold—then an Arizona forester and firefighter himself—first recognized the extent of our impact in 1924. He observed a sharp contrast in the age grouping of Arizona junipers—ancient, fire-scarred trees that stood in a matrix of very young trees, all less than 40 years old—with no age groups in between. Leopold surmised that beginning in the 1880's, something had intervened to keep fires from spreading after ignition. That "something" was ranchers and their livestock; the ranges were grazed "to death."

> Putting prescribed fire back onto the landscape would be a lasting memorial to the brave firefighters who lost their lives in 1994.

Even as Leopold documented his hypothesis, the USDA Forest Service had begun a campaign to exclude fire across the continent. Sparked by the fires of 1910 in the northern Rockies and prodded by Washington, the Forest Service took up fire suppression with a vengeance. The war on fire accelerated through World War II. Airplanes that had dropped paratroopers and bombs during World War II soon carried smokejumpers, fire retardants, and chemicals—all with the singular target of putting out every fire by 10 a.m. the next morning. It was an effective campaign. So effective, in fact, that even today it often mutes any suggestion that in some cases fire *improved* the health of

Interior Secretary Bruce Babbitt (front) constructing fireline on the Libby fire complex in Northern Montana with the Midnight Suns Hotshots. Photo: Joan Anzelmo, USDI, Washington, DC, 1994.

Bruce Babbitt is the Secretary of the United States Department of the Interior, Washington, DC.

[1]This article, in part, was first published as "To Take Up the Torch" in *American Forests*, vol. 101(7 & 8) in 1995.

ranges and forests and that there is a risk of excluding fire.

When Fires Are Excluded

Paradoxically, as fire exclusion escalates, wildfires fight back with increasing ferocity. In the absence of fire, ground fuel accumulates and crowded forests become more susceptible to disease and insect damage. So when lightning inevitably strikes, the odds are much higher that fire will flare up faster, burn hotter and higher, crown into the big trees, and demolish entire forests in what professionals call a "stand replacing fire." These intense, densely fueled wildfires are also increasingly expensive and unpredictable to fight.

The only way to break this vicious cycle is to put controlled fire back onto the land. We must return the flame to recreate the cycles of light burning where ground fires moved swiftly across the land, consuming brush and accumulated ground fuel, pruning out thickets, and maintaining healthy stands of forests.

Another advantage of prescribed fire is timing. Wildfires typically ignite at the worst time—during the dry "fire season," when they can break out of control and when human resources and equipment are stretched dangerously thin. By contrast, prescribed fire allows us to choose weather, temperature, and season for burning, often in the spring or fall when the air is cool and moist enough to keep fire within limits. Also, land managers have time to plan and construct adequate fire breaks or to reduce the fuel load by hand thinning around valuable sites and trees.

Figure 1—*Yearly average of acres (ha) burned by wildfires as compared to prescribed burns from 1984 to 1993, by agency.*

Agency	Acres (ha) managed	Acres (ha) burned by wildfires	Acres (ha) burned by prescription
Forest Service	191 million (77 million)	535,700 (216,800)	305,550 (123,650)
BLM	270 million (109 million)	876,000 (355,000)	68,339 (27,656)
National Park Service	80 million (32 million)	219,500 (88,830)	66,500 (26,900)
Fish & Wildlife Service	92 million (37 million)	466,859 (188,931)	142,000 (57,500)

Yet despite mounting evidence of the benefits, prescribed fire is still not widely used in the West (see fig. 1). From 1984 to 1993, on 270 million acres (109 million ha) of Bureau of Land Management (BLM) lands, wild and prescribed fire burned an average of 944,000 acres (382,000 ha) per year. At that rate, a given acre (.4 ha) of BLM land would burn once every 287 years. An acre of Forest Service land would burn once every 237 years.

By contrast, studies show the vast majority of western public lands, including rangelands, chaparral, and ponderosa forests, burned historically every 10 to 50 years. Prescribed burning should approach that historical level.

The Public's Reaction to Fire

Why have we been slow to return fire to its rightful place? For many years, the Smokey Bear-educated public saw only the risks of fire, not the benefits. Also, when the public learned that the smoke in their air came from planned fire, they instinctively opposed it. Similarly, the liability issues are quite real—no prescribed fire is ever 100 percent escape proof and property damage can and does occur.

After the public's initial shock at the damages in Yellowstone, once recovery began, it was clear that fires are a natural and necessary part of the ecological succession. The public must also learn that either we pay now with some inconvenience, or we will undoubtedly pay a higher price later with larger, smokier, uncontrollable wildfires. And while fear of liability can paralyze prescribed fire managers at any level, the alternative of allowing fuel to build up to feed the inevitable big wildfire is even worse, as hillside residents in southern California can readily testify.

Our Challenge as Land Managers

As managers of the land, our challenge is to assess those risks and work out cooperative protection

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agreements with participating landowners. Of course, we will have to coordinate prescribed fire plans with the Environmental Protection Agency and State air quality regulators. In addition, we must become forceful advocates of this forest health "tool." If we gave prescribed burning just a fraction of the time and energy that our predecessors put into fire exclusion campaigns, prescribed fire would soon take its rightful place on the land management agenda.

Bringing prescribed fire up to its full potential for restoring western forests and rangelands will require concerted action at both the Federal and State levels. A first, essential step is for Federal agencies to elevate prescribed fire to full status in the Federal Land Use Planning process. Both the Forest Service and the BLM are required by law to produce and regularly update land management plans at the forest and district level. Yet even a casual sampling of current plans reveals how little attention is paid to prescribed fire; most plans do not even discuss the concept, much less undertake serious analysis. Even environmental organizations—usually so quick to prod Federal agencies with lawsuits challenging the adequacy of the planning process—seem to have entirely overlooked the use of fire as a management alternative important enough to require discussion in virtually all land use plans.

Plans for the use of prescribed fire must include the States and their political subdivisions, for it makes little ecological or economic sense to confine prescribed fire to Federal lands when the benefits could be extended to all landowners—including State and private.

The Weeks Act

Fortunately, there is a good precedent right at hand. In 1911, a time when fire suppression efforts often failed for lack of coordination, Congress enacted the Weeks Act. This Act and successive legislation provided matching grants to those States willing to adopt comprehensive fire suppression plans acceptable to both the State and the Forest Service.

The time is right to expand this proven Federal and State partnership beyond fire exclusion to the broader objective of introducing fire onto the landscape as a routine management tool. Congress could extend existing Federal cooperative grants to require that States, to be eligible for existing revenue sharing, must produce prescribed fire plans acceptable to major Federal and State land agencies.

Arguably, we do not even need legislation, for the 1978 Weeks Act amendments expressly authorize the Secretary of Agriculture to provide assistance to the States to plan and organize programs of "prescribed burning." In the 18 years since those words were written into law, individual agencies have made sporadic progress; yet the development of true statewide, multiagency plans remains to be achieved.

In the end, however, plans are just so much paper without the leadership and money to put them into effect. Comprehensive prescribed fire plans will require additional funds. The logical source of funding is revenue produced by public lands. Just as rent is a source of funds for the maintenance and upkeep of a building, the receipts from the products of the land—like timber sales and grazing fees—should be allocated for upkeep of the land. We can easily obtain the dollars to invigorate and renew range and forest resources through prescribed burning.

A comprehensive movement that puts prescribed fire back onto the landscape, that increases the health and productivity of the land, and that reduces the risks and destruction of wildfires that do occur, would be a lasting memorial to the brave firefighters who lost their lives during the summer of 1994. ■

NWCG Recommends Use of New Incident Safety Analysis[1]

Paul Broyles and Don Aldrich

Idaho's Lake wildfire in September 1994 wasn't a large one—only 2,000 acres (810 ha)—but the country was quite steep with boulder scree and cliff faces on its northern head. The fire had exhibited extreme behavior in mixed conifer throughout its 2-day life. It was in high country—almost 10,000 feet (3,050 m) elevation—and had run up into the "goat rocks" and spotted across the ridgelines. We had to establish camps with resupply from the incident base in Swan Valley, using a number of helicopters to move crews and supplies. We knew we'd have problems managing incident medical evacuations (medivacs) as well as hikers and big game hunters in the area. We'd also have to assure the safety of "tourists" around the helibase and incident command post. Other significant hazards to personnel abounded, including the requirement to construct indirect and downhill fireline.

When the Incident Commander arrived at the incident command post, he directed his Incident Management Team to complete an Incident Safety Analysis, knowing that a coordinated approach to safety management was required to adequately address the various hazards associated with the fire.

The safety officer, operations section chief, and the planning section chief "brainstormed" all the hazards present on the fire (by division, as identified on the ICS-215 Operational Planning Worksheet) and what should be done to eliminate or mitigate those hazards. They found several items not pre-identified on the ICS-215A (see fig. 1), which they included in the blank columns, such as highway traffic running through the incident base and backpackers and hunters in the vicinity of the fire. After identifying numerous mitigation actions, the Incident Management Team reviewed the ICS-215A at the next planning meeting, identified several more hazards, and reached consensus about what mitigation actions should be taken.

The Lake Incident Management Team found that they collectively identified more hazards—and properly addressed them—than they would have individually. Downhill, indirect line was successfully and safely completed; hundreds of flight hours were flown without incident; two air medivacs were successfully implemented, including a life-threatening anaphylaxis case (allergy to a wasp sting); several hundred firefighters were safely camped in two locations far from the incident base for 9 days; hunters, hikers, and campers were removed from closed areas; and a road near the incident base was closed to nonofficial travel. Subsequently, the agency administrator gave the Incident Management Team "high marks" for emphasizing safety management; in large part, this was due to the successful use of the Incident Safety Analysis process.

For some years, members of the National Wildfire Coordinating Group's (NWCG) Safety and Health Working Team have been concerned that wildland fire managers have not always addressed safety issues from an integrated, process-oriented approach. "Accidents" continued to happen that might not have occurred if hazard identification and subsequent mitigation efforts had been implemented systematically. The Working Team felt that a structured "job hazard analysis" process was needed, one that addressed the kinds and types of hazards normally associated with wildfire suppression and prescribed fire operations. This "job hazard analysis" had to expand upon the 18 "Watch Out Situations," address other common wildfire hazards, and also allow individual customizing. While intended primarily to identify hazards involving incident personnel, it could also be used to identify hazards and required mitigation actions for others affected by the incident (those for whom the Incident Management Team might be responsible, e.g., hunters, backpackers, homeowners).

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Paul Broyles is the national suppression, training, and safety specialist for the USDI National Park Service, Branch of Fire and Aviation Management, National Interagency Fire Center, Boise, ID. Don Aldrich is senior resource manager, Idaho Department of Lands, Payette Lakes Area, McCall, ID.

[1]This article, in part, was first published as "Incident Safety Analysis" in Vol. 8, no. 2 of "Wildfire News & Notes," published by the National Fire Protection Association.

Figure 1—*The Lake Fire Incident Safety Analysis, form ICS-215A, showing L.C.E.S. analysis of tactical applications and other risk analysis.*

***LCES ANALYSIS OF TACTICAL APPLICATIONS** | **OTHER RISK ANALYSIS**

Division/Group	Downhill Fireline	Underslung Fireline	Indirect Fireline	Mid-Slope Fireline	Frontal Assault	Anchor Points	Extreme Conditions (Spotting, Wind-driven)	Unburned Area	Snags	Steep slopes	LCES Mitigations	Hazardous Materials	Transportation Line	Communications	Structure Protection	Multi-Aircraft	Public Traffic... Patrolling	Other Risk Mitigations
A		✓	✓				✓	✓	✓	✓	Post lookouts. Reinforce verbal warnings. Communicate!	✓				✓	✓	Use proper fuel containers. Provide containment areas.
B		✓	✓				✓	✓	✓	✓	Escape routes - Downhill; sideslope; into black; into meadow and	✓				✓	✓	Helicopter/helibase manager air attack, air support in place.
C	✓		✓		✓ spots		✓	✓	✓	✓	burnout. Use direct line. Frontal attack mitigated	✓				✓	✓	Close road in front of camp to public traffic.
D			✓		✓ spots		✓	✓	✓	✓	by LCES. Flag hazard trees.	✓				✓	✓	Restrict trail access and enforce closure.
											Be aware of changes in weather, especially winds. Advise Line ASAP							
											Frequent and consistent spot weather forecasts.							

ICS 215A 11-93 **INCIDENT SAFETY ANALYSIS (*LCES)** *Lookouts, Communications, Escape routes, Safety zones (LCES)

1. Incident Name: Lake Fire — Don Aldrich-Safety Officer
2. Date Prepared: 9/4/94 — Time Prepared: 1830
3. Operational Period (Date/Time): 9/5/94

Foremost was the requirement to use the 10 standard "Fire Orders" to mitigate common wildfire hazards, with emphasis upon "Lookouts," "Communications," "Escape Routes," and "Safety Zone(s)" (L.C.E.S.). For a full explanation of the "L.C.E.S." systems approach to fire safety, see Gleason (1991). Additionally, all other reasonable mitigation standards and procedures would be used: the "Fire Orders" and "L.C.E.S." may not be sufficient in themselves to assist in mitigating each hazard identified.

The Incident Safety Analysis Arrives

Thus was born the ICS-215A—"Incident Safety Analysis" form—and a formalized safety planning process. Briefly, an Incident Safety Analysis is a tool used to formally

What is an Incident Safety Analysis? Where did it come from? How does it benefit firefighters or other users? How is it used?

incorporate safety management into the incident planning process. The analysis process assists in identifying hazards, then requires appropriate measures be identified to mitigate those hazards adequately. While optional in the Incident Command System, all Incident Commanders and management teams are encouraged to use it—its significance and value are applicable to all incidents, from the smallest Type IV to the largest Type I incident.

The process was successfully tested by National Type I Incident Management Teams during the 1991 and 1992 fire seasons, and the Working Team subsequently revised the form. In addition, its use has been taught at the National Advanced Resource Technology Center in Marana, AZ, as S-520 "Advanced Incident Management" and is being included in other NWCG courses such as S-404 "Safety Officer" and S-440 "Planning Section Chief."

Benefits of the Analysis Process

When Incident Management Teams properly and consistently use the process (regardless of the incident's complexity), they can definitively identify potential problem areas, geographically or

functionally. From this information, they can determine appropriate mitigation actions. If the problem areas cannot be reasonably mitigated, the teams must then select a different strategic or tactical approach to manage the incident.

The Incident Planning Process Checklist (fig. 2) is intended to be used with the Operational Planning Worksheet (ICS-215) and the Incident Safety Analysis (ICS-215A). The two forms are designed to be used simultaneously, identifying risks in each division or group and required mitigating measures to be taken.

The operations section chief and the safety officer should complete a draft Incident Safety Analysis prior to the planning meeting, based upon the Operational Planning Worksheet previously completed by the operations section chief. The Incident Management Team then reviews the analysis and revises as necessary, prior to beginning the next operational period.

Specific actions and outputs resulting from this Safety Analysis process might include:

- Special instructions on the Division Assignment List (ICS-204) for each division or group to ensure that involved personnel understand the hazards and the mitigation actions they should implement.
- Specific assignments of personnel as lookouts, safety officers, or to meet other safety needs.
- Designation of safety zones and escape routes on the incident map.
- Key points for discussion at briefings and debriefings.

Figure 2—*Incident Planning Process Checklist, with inclusion of Incident Safety Analysis process.*

Planning Process Checklist

Planning Step	Primary Responsibility
1. Give briefing on situation and resource status.	Planning Section Chief
2. Review incident objectives.	Incident Commander
3. Plot control lines.	Operations Section Chief
4. Specify tactics for each "planning unit."	Operations Section Chief
*(Complete safety analysis for each "planning unit.")	Operations Section Chief and Safety Officer
5. Determine control force requirements and specify resources needed for each "planning unit."	Operations Section Chief
*(Safety Analysis still valid? Needed resources still available?)	Operations Section Chief and Safety Officer
6. Combine planning units into divisions and/or segments.	Operations Section Chief
7. Specify operations facilities and reporting locations. Plot these on map.	Operations Section Chief
*(Verify Incident Safety Analysis mitigation measures.)	Incident Management Team
8. Consider communications, medical, and traffic plan requirements.	Logistics Section Chief
9. Finalize Incident Action Plan.	Planning Section Chief
10. Approve Incident Action Plan.	Incident Commander

*Additions to existing Planning Process Checklist, which refer specifically to the ICS-215A process.

"An Incident Safety Analysis is a tool used to formally incorporate safety management into the incident planning process."

- Areas of focus for fire behavior analysts and safety officers.
- Identification of potential need to review and/or revise the Escaped Fire Situation Analysis with the host agency administrator(s).
- Documentation of incident risk assessment and decision process.

Create Your Own Analysis Form

This Incident Safety Analysis process is applicable to other types of incidents, not just wildland fire. Simple modifications to the ICS-215A, based upon the type of incident, would facilitate an improved risk assessment and mitigation decision process. With a data base manager on your computer, one can create a blank form ICS-215A and choose from a menu of hazards as daily local conditions warrant. See figure 3 for an example of a menu of general fire hazards that can be used in a blank ICS-215A.

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A similar menu could be created for hazards in other incidents. As examples, consider the possibilities in mitigating the effects of hazardous materials, earthquakes, or floods.

To obtain the Incident Safety Analysis, ICS-215A, as well as other ICS forms, contact the National Interagency Fire Center, 3833 S. Development Ave., Boise, ID 83705, tel. 208-387-5542. As with the Operational Planning Worksheet, ICS-215, the Incident Safety Analysis form is available in both 8-1/2" x 14" (21.5 cm x 35 cm) and laminated wall chart sizes.

Literature Cited

Gleason, Paul. 1991. L.C.E.S.—the key to safe procedures. Wildfire News and Notes. 5(2): 1, 4. ■

Figure 3—*Menu of tactical applications and other risk analysis to be used in a blank ICS-215A**.*

L.C.E.S. Analysis Of Tactical Applications	Other Risk Analysis
A. Initial action	AA. Small fire or isolated section of large fire
B. Lack of management personnel	BB. Snags
C. Ineffective communications	CC. High winds predicted
D. Downhill fireline construction	DD. Fire below crews
E. Underslung fireline	EE. Rolling rocks
F. Indirect fireline	FF. Unburned fuels
G. Midslope fireline	GG. Thermal belt effects
H. Frontal assault	HH. Light fuels
I. Lack of anchor points	II. Narrow or box canyons
J. Long shifts	JJ. Fatigue and/or heat stress
K. Inadequate or insufficient lookouts	KK. Steep slopes
L. No escape routes or safe zones	LL. Rugged terrain
M. Burnout operations	MM. Poor visibility
N. Use of chain saws	NN. Emergency hires
O. Use of dozers	OO. Inversion
P. Use of engines	PP. Hazardous materials
Q. Use of fireline explosives	QQ. Mine shafts
R. Night shift	RR. Power lines
S. Structure protection	SS. Altitude effects
T. Transportation • Over 1 hour or one-way • High speed highway • National Guard • Contractors • Bridge limits • Narrow or 4 x 4 only	TT. Extreme burning conditions: • Spotting • Wind-driven • Dead or dying standing fuels • Freeze-dried fuels • Thunderstorms • Frontal passage
U. Multiaircraft use	UU. Wet, slippery ground
V. Air shuttles	VV. Poison oak/ivy
W. Sling loads	WW. Lack of drinking water
X. Retardant drops	XX. Snakes
Y. Bucket drops	YY. Bees
Z. Other:	ZZ. Other:

**The author of this menu is Tony Dietz, safety officer on a Rocky Basin interagency Type I Incident Management Team.

How To Increase Helicopter Safety

Dean Vendrasco and Sam Swetland

At your helibase, does everyone have all the information necessary to fully contribute to the success and safety of each mission? If you've been concerned about your "situational awareness," you'll want to explore a new tool that ensures that all pertinent information is shared at daily briefings and, for that matter, throughout an incident.

The tool—Helibase Display Boards—makes certain that everyone participates in quality, effective briefings and debriefings. When everyone shares information about the incident, aircraft, organization, and objectives, each individual is better able to contribute to the overall mission and safety record of the aviation branch.

The boards provide a visual display in a large-scale, readable format, have a professional appearance, and will stand up to harsh environmental conditions (see fig. 1). Planners on the helibase—including the air operations branch director, the air support group supervisor, and the helibase manager—can obtain information from the boards for either short- or long-range planning.

Dean Vendrasco is an assistant fire management officer for the USDA Forest Service, Willamette National Forest, McKenzie Ranger District, McKenzie Bridge, OR; and Sam Swetland is a fuels planner for the USDA Forest Service, Willamette National Forest, Blue River Ranger District, Blue River, OR. Both of these authors are aviation branch members of Incident Command Teams.

Helibase Display Boards assist the helibase manager and the air support group supervisor in their morning briefings as well as end-of-shift debriefings. These boards are an orderly and professional way to introduce new crew people and pilots to an incident.

The Helibase Display Boards, screen printed on a durable polyvinyl material and grommeted for easy display, are similar to the large-scale presentation of the "Operational Planning Worksheet" (ICS-215) used by the Planning Section of Incident Command Teams. The display boards contain 11 forms, checklists, and charts and are scaled to fit on two standard 4 x 8 foot (1.2 x 2.4 m) sheets of plywood, commonly used in fire camp. Most of the forms and checklists are included in the "Interagency Helicopter Operations Guide" (NIFC 1994). The original copies of the display boards were plotted on white plotter paper as well as clear film mylar with AutoCad software and an electrostatic plotter.

Those presenting briefings can write on the boards with either a grease pencil, "dry erase" pen, or "Vis-a-Vis" pens (overhead projector pens). Once the incident winds down, the boards can be easily erased, rolled up, and inserted in a map tube—in a few minutes they are ready for the next incident.

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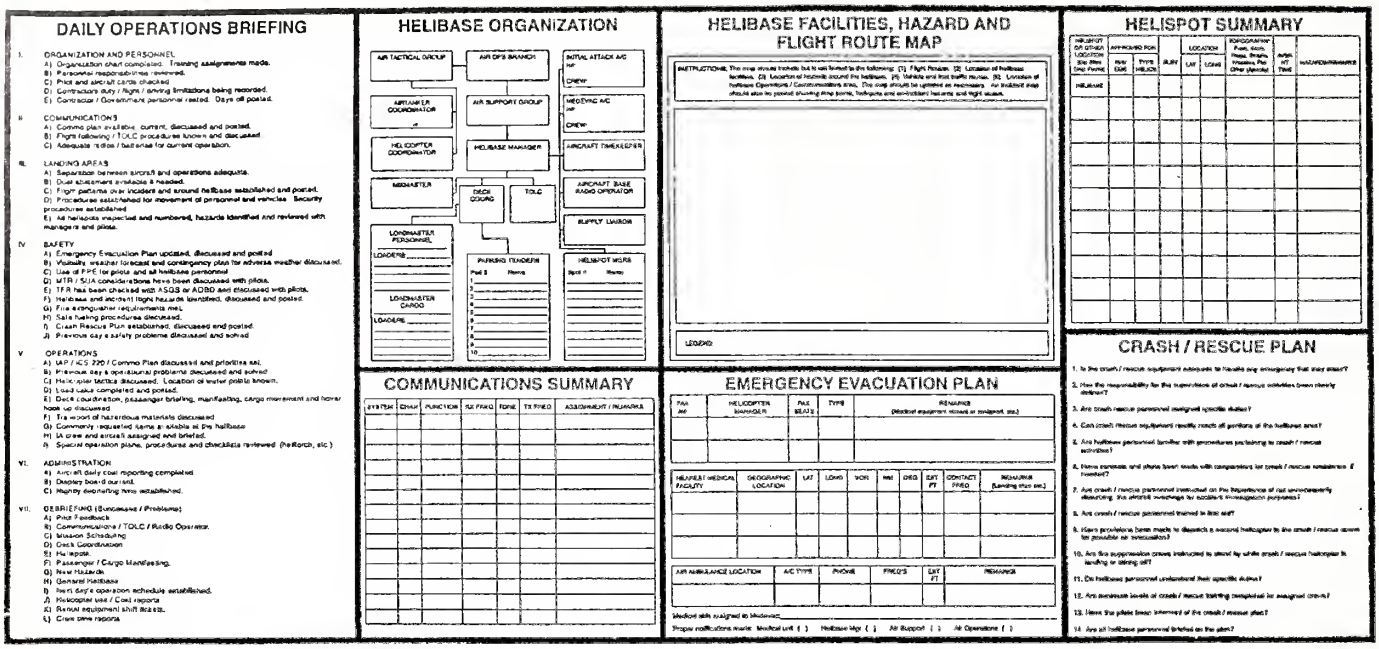
Dean Vendrasco (left) and Sam Swetland conducting a morning briefing with the use of Helibase Display Boards. Photo: Dean Vendrasco, USDA Forest Service, McKenzie Ranger District, 1995.



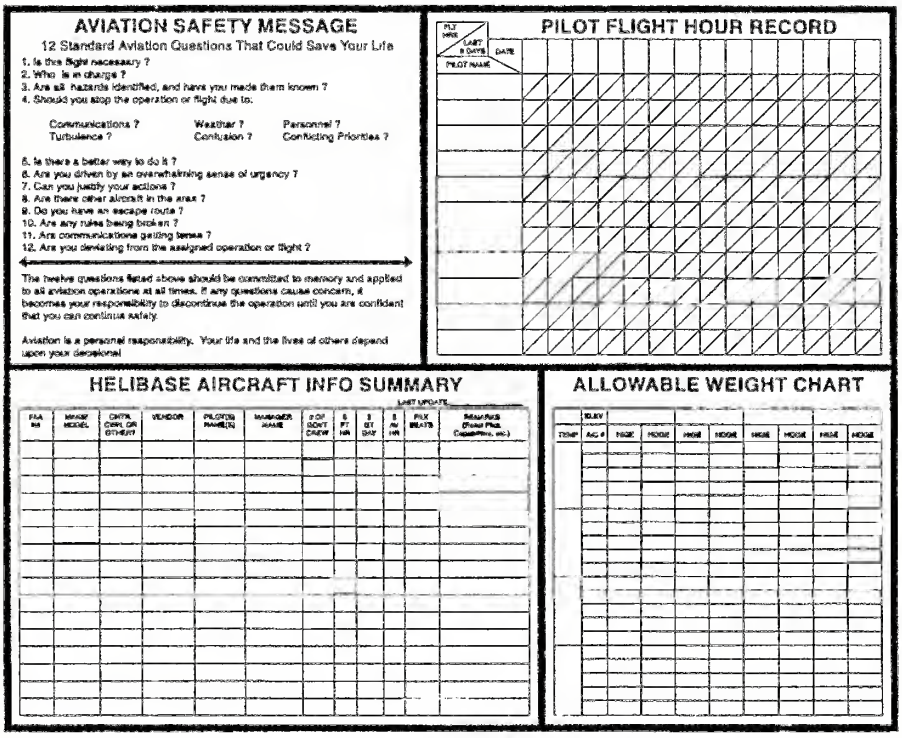


Figure 1—*The 11 forms, checklists, and charts that are displayed on the Helibase Display Boards.*

We selected and organized the information found on the display boards after asking ourselves the following three key questions:

- What information is commonly used or needed at helibases and briefings?
- What information is commonly used or needed for planning purposes?
- What kinds and types of information frequently show up at helibases?

In addition, we standardized the content of the display boards so all agencies can use it. Because the boards are sturdy and reuseable, they are inexpensive to use and can be set up quickly at incidents, thus reducing confusion while increasing safety. The display boards, however, are not intended to replace proper documentation and recordkeeping.

Some of those who assisted in the production and distribution of the display boards, beginning in 1994, are Jon Skeels, computer specialist, USDA Forest Service Region 2 (Colorado); Jim Evans, forest civil engineer, Region 8 (Arkansas); and Greg Gall and Hugh Carson, aviation specialists at the Bureau of Land Management's Nevada State Office. First-year testing was conducted in the Pacific Northwest and Great Basin. Review copies were sent to each region's helicopter operations specialist. Lanny Allmaras, aerial attack specialist from the Washington Office West, and Dick Dale, Region 6 helicopter operations specialist, provided leadership, guidance, and financial support throughout the life of this project.

Regions 1, 2, 4, and 6 used the boards successfully at helibases on

some of the most complex fires in the west in 1994. After field testing by users on real incidents during that fire season and receiving comments from pilots and others regarding their use, we made some changes to content and arrangement on the boards. Further development was encouraged at the National Helicopter Operations Specialists' meeting in January 1995.

We completed the final format in the spring of 1995. The boards will now be distributed to each geographic area with the help of Dick Dale. If the content of the boards and material that they have been printed on prove to meet standards, they will be included in the National Cache System.

Future plans include making available the "Standard Aircraft Safety Briefing" board in a large-scale format to post in passenger loading areas at helibases to facilitate and assist preflight briefings. This briefing board will include required personal protective equipment, approach and departure paths, seating in aircraft, location of emergency exits, methods for loading equipment, and helicopter in-flight emergency procedures.

For more information on the Helibase Display Boards, contact Dean Vendrasco, McKenzie Ranger Station, McKenzie Bridge, OR 97413, DG:R06F18D07A, telephone 503-822-3381; or Sam Swetland, Blue River Ranger Station, Blue River, OR 97413, DG:S.G.Swetland:R06F18D01A, telephone 503-822-3318.

Literature Cited

National Interagency Fire Center. 1994. Interagency helicopter operations guide. NFES 1885. Boise, ID: National Interagency Fire Center: 17 chapters and 13 appendices. ■

Decompression Is Important

As we see our work suppressing a wildfire coming to an end, we know we'll soon return to our "normal" lives. But just as deep-sea divers know it's important not to ascend to the surface too rapidly, we firefighters have to learn to "decompress," to slowly rejoin our friends and families and colleagues in the "real world." Wildland firefighters don't have decompression chambers to help us, so we need some training to help make this transition as painless as possible. Following are some tips for a slow, safe withdrawal from fireline life:

- Before leaving fire camp, record the sound of helicopters flying overhead and/or the sound of generators near the food unit.
- Your first evening at home, start a roaring fire in the fireplace, turn off all the lights, and read a comic book by flashlight.
- When it's time for bed, turn on all the lights in your room. Leave them on all night.
- Sprinkle some dirt and pine needles on your sheets.
- Put some rocks and your dirty socks beneath your pillow.
- When you get into bed, be sure you've still got boots or shoes on. Wear the same clothes you've had on all day.
- If your bed is too comfortable, sleep in an old, dirty sleeping bag near the fireplace and/or as close to the kitchen as possible.
- Replay your helicopter or generator recording as you try to fall asleep.
- Ask the person who delivers your paper to honk your car horn for you as early as possible—preferably around 4 a.m.
- Turn the hot water faucet on full blast for at least an hour, so by the time you're ready to take your shower, the water will be properly chilled.
- For breakfast, make an omelet and put it on a plate; then pour a cup of coffee. Refrigerate both for 15 minutes while you make a processed meat sandwich for lunch and put it on the seat of your chair. Place your omelet and coffee on the table, sit down on your chair, immediately lay your head in the plate, and go to sleep.
- Ask someone else to drive you to work. Ride in the trunk with your sandwich and a can of soda. Tell your driver to forget to pick you up when it's time to go home.
- Wear a stuffed backpack all day at work; if it's too comfortable, put some rocks in it.
- At lunch time, take your sandwich outside and drop it in a flower bed. Retrieve it and stand beside a full garbage can while you eat it. Wash it down with a soda that's been in the car trunk all morning.
- Several times during the day, hit yourself in the shins with a hammer.
- Repeat any or all of the above until all symptoms of withdrawal are gone and you've had a successful reentry into "normal life." ■

Are You Ready for a Project Fire?[1]

Tom Reilly

If you have a project fire on your district this year, are you ready to deal with it? If your career path has been untraditional like mine, perhaps your answer is "no." Until last year, mine was too. What's different now is that I took the most important step I could have taken to get prepared—I went out on two fire assignments as a trainee.

A bit of career history: I came into the Forest Service in 1977 from the Corps of Engineers as a GS-9 geologist, assigned to the Olympic National Forest Supervisor's Office (SO). All of the agency was foreign to me—particularly the signs I noticed posted on ranger district office doors urging people to take their step test in the spring.

"What does this mean?" I asked my coworkers.

"Oh, that's for firefighting," I was told.

"So, have you taken the test?" I inquired.

"Oh no, that's for district folks. We work in engineering in the SO; we don't have to do that."

At the time that seemed logical enough to me. But as the years went by, I began to realize that support for fire suppression (within one's physical capabilities) was an expectation most line officers have of all employees. The trouble was, I had come into the agency at midcareer from a nontraditional path, with no entry-grade experience on a district, no guard school, no training, no orientation.

> "I want to share my passion for the safety of the dedicated men and women who do the firefighting job and thank them first-hand for a job well done."

In the 1980's, as forest geologist on the Gifford Pinchot, I encountered another barrier—my work for the Forest Planning team was considered "too important" to be interrupted by fire assignments.

Yet I began to notice something in the tales fellow employees brought back from their fire assignments. It was hard work, they said, but it brought a feeling of accomplishment and a spirit of teamwork. It was an opportunity to see coworkers from previous fires or previous assignments. It was a change of pace, a chance to re-focus energies while performing a critically needed task for society. I began to realize that "fire work" is woven into the fabric of Forest Service "culture," yet I didn't even know the jargon.

Ignorance Is Not Bliss!

"You have to start somewhere," I told myself; so even without training, I took the step test. Being an avid jogger, I scored in the low 60's.

"That's really good," my fellow workers said; "so what fire positions do you qualify for?"

"None yet," I told myself, though I did serve as a driver on a fire.

Before I could get training, I moved on in my career, this time to manage the Westside Engineering Zone on the Siskiyou in Gold Beach. With the encouragement of former fire management officer (FMO) Wayne Spencer, I took basic Incident Command System (ICS) and fire business management training and then applied for trainee positions on the Type II Cal-Or team. Then I took the BIG plunge: I went to guard school! I have to admit, I felt a bit out of place at age 39, but I was glad I went.

Fear and Trepidation

Four months later, I became District Ranger at Walla Walla. With a very solid, competent fire organization, as well as other seasoned district employees and staff, I wasn't totally stressed out about my lack of experience—but 1992 looked like it might be the year of the "big one." Would it be on the Walla Walla District? I certainly hoped not—I wasn't ready!

Two more years passed—fortunately, quiet fire years for the District. The time for action had come:

Tom Reilly is a district ranger for the USDA Forest Service, Umatilla National Forest, Walla Walla Ranger District, Walla Walla, WA.

[1]This article is reprinted, in part, from the March 1995 "Greensheet," the Pacific Northwest Region's employee newsletter.

I would go out with an area Type II team as a trainee at the earliest opportunity in 1994. Early that September—at 2030 on Saturday night—I got the call: Report to fire camp as a planning section chief trainee on Sunday at 0500!

The Real Training Begins

The fire was on the south end of the Umatilla, being managed by the Blue Mountain Type II Team. After the briefing, I introduced myself to Incident Commander (IC) Dave Lukens and plans chief Mike Marsh, told them I had no experience, but made it clear that I was willing to help in any capacity.

Help the resources unit leader with check-in? No problem (what is a T-card anyway, and why all the colors?). Help prepare the daily Incident Status Summary? Glad you asked (just what does a situation unit leader do?). Help prepare the fire history summary for the incident? Happy to help (so that's what happened and how the plans and tactics were developed!). Take the lead in pulling together a "term paper" for the incident (for line officer debriefing, when the fire was turned back to the forest)? Yes, and thanks for asking!

Putting It All Together

I came to that fire near the end of the incident. I learned more in a week than I ever would have learned reading about Escaped Fire Situation Analyses (EFSA's) in my office! But I needed more. I needed to be in on an incident from the beginning. Late that month, the phone rang again. Could I join the team on a new incident the next morning in time for the line officer briefing? Yes!

Author Tom Reilly urges others who haven't come "up the ranks" that they too can ready themselves for a project fire. Photo: Bruce C. Poland, USDA Forest Service, 1994.

Here things came together for me as I learned what is entailed in the following:

- Ordering resources.
- Deciding where the camp should go.
- Consulting with National Marine Fisheries (we were in threatened salmon country).
- Meeting the resource advisor.
- Calling in a fire assessment team.
- Dining with the team in a private pasture on food ordered just 8 hours before!

The next morning, resources began to arrive in droves, and the pace of fire camp really took off. Helicopters arrived—Hotshots and Snake River Valley (SRV) crews—more helicopters, more overhead, tents everywhere, showers! After a few days, the rhythm and routine began to make perfect sense.

Then I had even more opportunities to help and learn:

- I worked with operations personnel (speaking a language I barely understood).
- There were special assignments from the IC (e.g., reviewing the fire assessment team report).
- Attending three briefings a day, I observed how the line officer and resource advisor interacted with the command staff and IC.
- I went through the demobilization process.
- I learned just how critical the finance and logistics sections are to the entire effort.

Training just doesn't get any better than this!

Consider the Possibilities!

Yes, there is much more for me to learn. But now, if asked where a fire camp should go on the district, I will know what that question entails. I will better understand a situation update, fire behavior terms, fuel conditions, and resource shortages. I know what an IC needs from the line officer and resource advisor to do his or her job. I will delegate with more confidence. I will know just how important an EFSA is. Perhaps most of all, I will be able to relate much more effectively with my own district fire organization, understand the challenges they face, and appreciate the obstacles they overcome.

So, where do I go from here? To field observer training, of course! I yearn for an assignment near the line—where I can apply my field skills. I don't mean digging line with my defective, middle-aged back, but I'd like to be there providing good information. I want to share my passion for the safety of the dedicated men and women who do the firefighting job and thank them first-hand for a job well done. Who says an old geologist can't learn new tricks? You can too! ■

A Wildfire Safety Officer's Perspective

Tony Dietz

Each year wildland fires burn, and each year young men and women are injured and killed attempting to control them. Because of the tragedy at South Canyon in 1994, fire management has been making indepth analyses of various aspects of firefighter safety.

In their analyses, fire managers have determined that firefighter risk and hazards assessments have been addressed for decades and that safety guidelines applicable to each and every wildfire situation have already been produced. The 18 "Watch Out!" Situations and the 10 Standard Fire Orders have been consistently validated. But if these established guidelines are already in place, why do so many firefighters continue to be added to injury or fatality lists? To answer this question, let's first look at some statistics.[1]

Fatality Statistics

Since 1926, over 500 firefighters have lost their lives while fighting wildfires, averaging over 7 deaths per year. Statistics for the most recent 5 years—1990-94—record an average of over 16 deaths per year, more than double the previous averages.

Tony Dietz is the urban forestry coordinator, Utah Division of Sovereign Lands and Forestry, Salt Lake City, UT.

[1]Those wishing to examine fatality and entrapment statistics referred to in this article and contained in the National Wildland-Fire Coordinating Group's Safety Grams should contact Stan Palmer, National Interagency Fire Center, 3833 S. Development Way, Boise, ID 83705-5354; telephone 208-387-5507.

> "The level of risk involved with the suppression effort must not exceed the benefits to be derived."

One reason for this "increase" is better recordkeeping. Prior to a quarter of a century ago, the only recorded statistic was for firefighter deaths caused by fire burnover. Recent statistics include firefighter deaths caused by aviation and vehicle accidents, falling snags, heart attacks, drowning, lightning, and other causes. More than half of the 83 fatalities on wildfires in the last 5 years have been from causes other than the fire itself.

The 18 "Watch Out!" Situations and the 10 Standard Fire Orders do not address the majority of causes of firefighters' deaths. A parallel example is the Desert Storm War with Iraq—more allied soldiers were killed in accidents away from battlefields than in combat. In wildland fire suppression, the focus of safety has been primarily directed toward the risks associated with fire exposure rather than to other risks associated with wildfire fighting.

Two other reasons why more wildland firefighters have been killed in recent years than in the past are: 1) a recent increase in the number of wildland fires, and 2) more firefighters in the field now than ever before. An increase in risk exposure leads directly to an increase in fatalities. The years 1991 and 1993 were relatively light fire years, resulting in a relatively lower number of fatalities (8 and 12 per year, respectively), while 1994 was one of the most intense fire years on record, resulting in 34 fatalities.

Safety management must include an analysis of all the risks associated with wildfire fighting and not just exposure to fire. This includes a preresponse assessment of those preparing for the job, including an analysis of individuals' physical fitness, training, and experience.

The conditions under which the response is to be made should also be analyzed. Questions such as the following should be asked:

- What equipment is available?
- Can the equipment do the job?
- How quickly can additional equipment be deployed?
- How adept is management support?
- What are the transportation needs and how will these needs be met?
- Are existing communications and technologies reliable?

In wildland fire management, safety has traditionally been viewed as a part of every other job on a fire. Hazards exist in all the various functional areas. Trainers must attempt to stress safety consciousness to our agency's administrators and firefighters at preseason train-

ing sessions. Safety considerations begin with the agency or interagency fire management organization before fires start. Preseason preparation and standard operating procedures must incorporate safety into all aspects of the fire job. Agency administrators have the responsibility to institutionalize a "safe practices" attitude among those they lead, and they must ensure compliance with safe working practices. Line officers are directly accountable for firefighter safety under their jurisdiction.

When the alarm sounds, the job of safety management extends, not transfers, to the firefighters on the ground. Time becomes a critical factor at this point and safety, by itself, often has taken a back seat to suppressing the fire. During initial attack, the safety job falls solely on the firefighters on the ground under the direction of an Initial Attack Incident Commander (IAIC). There is no one else available at this point to manage safety. In addition to conducting the attack, the IAIC must handle all other aspects of the operation including logistical support, air operations, planning and placing orders for resources, financial accountability, and establishing contacts with citizens and the media. Often, hazard identification and total risk assessment is lost in the shuffle.

As a fire grows, it expands in complexity as well. When the IAIC is overwhelmed and calls for assistance, the safety officer (a position

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A Checklist From an Incident Management Team's Safety Officer

In addition to the 18 "Watch Out!" Situations and the 10 Standard Fire Orders, Tony Dietz, who is a member of a Great Basin interagency incident management team, suggests that supervisors and firefighters should also:

1. Assess the basics of fire behavior—fuels, weather, and topography—and how they influence the fire.
2. Post **L**ookouts, establish **C**ommunications, select **E**scape Routes to adequate **S**afety Zones (**L.C.E.S.**).
3. Look up, look down, and look around for hazards within the fire environment.
4. Assess the fire environment for the four common denominators of fire behavior on tragedy fires.
5. Assure that safety zones are large enough to accommodate the work force, taking the anticipated potential fire intensity into consideration.
6. If it takes twice as long to get into an area due to rugged terrain or brush, plan to leave twice as fast when conditions begin to deteriorate.
7. Realize that the four major areas of safety concern on fires are the line, transportation, air operations, and camp.
8. Perform only those jobs for which they are qualified.
9. Participate in crew safety briefings before, during, and after each operational period.
10. Coordinate efforts with adjoining forces.
11. Communicate with adjoining forces prior to initiating burn-out operations, and patrol for spot fires.
12. Assess all trees—dead or alive—in the work area.
13. Carry fire shelters where they may be quickly deployed.
14. Realize that goggles are only effective if worn over the eyes.
15. Be aware that a rolling rock can kill.
16. Watch each step.
17. Keep at least three tree lengths from felling operations.
18. Acknowledge that there are no safe areas near working dozers.
19. Look for special hazards in areas of human activity, e.g., mine shafts, power lines, structures, highways, and fuel storage.
20. Listen to and obey helitack personnel.
21. Move away from areas where helicopters are dropping water.
22. Attempt to rotate out of smokey areas from day to day.
23. Stay awake during night operations.
24. Be prepared for rain, cold, dark, wind, and smoke.
25. Drink enough water to replace fluids lost through perspiration. When working, drink at least 1 quart per hour. Avoid coffee and soda because they act as diuretics.
26. Lift heavy loads with the legs, not the back.
27. Rest when it is time to rest; avoid sports in camp.
28. Arrange to get at least 1 hour of rest for every 2 hours of work, including travel.
29. Wash hands before eating.
30. Because old Nomex shirts may be dangerous (have a cotton base or have been contaminated with gas, oil, or resins), get new ones.

within the Incident Command System) becomes part of the team. The transition from an initial response to an Incident Management Team operation supports a more effective and safe suppression effort.

The safety officer on a large fire ensures that all of the hazards in that particular situation are identified, prioritized, and addressed by the members of the Incident Management Team. The safety officer then monitors the situation to ensure that the Incident Management Team eliminates, reduces, or controls hazards so that the risk potential for damage, injury, or death is commensurate with the benefits derived from the suppression effort.

The value of the safety officer expands with the complexity of the incident. A qualified safety officer should join a suppression team at the extended attack stage (Type III)—when the IAIC requests additional overhead to assist in managing the incident. Type I and Type II Incident Management Teams will have a safety officer assigned to the team.

Outlook for the Future

The safety of our wildland firefighters in the future will depend on how well each individual hazard on each fire is addressed by the responsible agency administrator, the agency fire management staff, the interagency dispatch office, and the responding firefighters. The level of risk involved with the suppression effort must not exceed the benefits to be derived (i.e., resource values to be protected). When the combined risk involved with an incident exceeds the benefits to be obtained from the proposed suppression action—after mitigation measures have been implemented—then the suppression effort must be terminated. During initial attack, the only person who can make this determination is the IAIC. On a complex incident, the Incident Management Team makes this determination. This usually results in a better assessment than one made by an individual; hence the old adage, "No one is as smart as all of us." The individual who must assure that this process takes place is the safety officer.

Summary

Unfortunately, firefighters will continue to perish on wildfires. Firefighting is a high-risk occupation. The 18 "Watch Out!" Situations and the 10 Standard Fire Orders are safety guidelines. They are worthless unless each firefighter acknowledges and adheres to them before, during, and after each fire. Fatalities are the result of an inadequate assessment of the hazards associated with each particular incident combined with inadequate or inappropriate implementation of mitigation measures. ■

Guidelines for Contributors

Editorial Policy

Fire Management Notes (*FMN*) is an international quarterly magazine for the wildland fire community. *FMN* welcomes unsolicited manuscripts from readers on any subject related to fire management. (See the subject index of the first issue of each volume for a list of topics covered in the past.)

Because space is a consideration, long manuscripts are subject to publication delay and editorial cutting; *FMN* **does** print short pieces of interest to readers.

Submission Guidelines

Authors are asked to type or word-process their articles on white paper (double-spaced) on one side. Try to keep titles concise and descriptive; subheadings and bulleted material are useful and help readability. As a general rule of clear writing, use the active voice (e.g., Fire managers know . . . **not** It is known . . .).

Submit articles to Donna Paananen, Editor; *Fire Management Notes*; USDA Forest Service; North Central Forest Experiment Station, 1407 S. Harrison Road, Room 220; East Lansing, MI 48823-5290; telephone 517-355-7740. Internet: FSWA/S=D.Paananen/OU1=S23L03A@MHS.ATTMAIL.COM. Data General:S23L03A. Include with the paper copy the complete name(s) and address(es) of authors as well as telephone and Fax numbers and e-mail information. If the same or a similar article is being submitted elsewhere, include that information also.

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Figures and illustrations (black ink drawings when applicable), and slides and clear photographs (preferably glossy black and white prints) are often essential to understanding of articles. On the back, please label carefully (Figure 1, Figure 2; photograph A, B, C, etc.). Also include your complete name and address if you wish your material returned, and indicate the "top." Clear, thorough captions (see recent issues) should be labeled to correspond with these designations.

All photos and illustrations require a written release, whether taken or drawn by government or nongovernment photographers and designers. Authors not in the Federal government sign a release acknowledging that they are aware that their work will be in the public domain. Please request forms from the editor. ■

Beyond the Safety Zone: Creating a Margin of Safety

Mark Beighley

Wildland firefighting is fraught with hazards. When firefighters encounter those hazards, they are at risk—risk of injury, risk of death. To guarantee safety while wildfires are suppressed, humans would have to stop being involved in firefighting. In most cases, this is not an option. We need firefighters to save lives, protect communities, and reduce damage to natural resources. Yet the question remains—how can firefighters suppress wildfires efficiently without jeopardizing their own lives?

Safety:	Freedom from danger, risk, or injury.
Zone:	An area, region, or division distinguished from adjacent parts by a distinctive feature or character.
Safety Zone:	An area distinguished by characteristics that provide freedom from danger, risk, or injury.

Firefighters Have Alternatives

Firefighters must consider current and future weather and burning conditions and the effect they have on how, what, and where the fire is expected to burn before making decisions about the best suppression strategy to use. For any given suppression operation, firefighters can choose from a variety of strategic and tactical alternatives. Some alternatives maximize the effectiveness of the suppression effort, and some maximize firefighter safety. Sometimes the most effective suppression action is also the safest, but generally there is a tradeoff between the two. Firefighters must always evaluate the risks before selecting a course of action. They may have as little as a few minutes to conduct this risk analysis on fast-spreading fires. On fires that have not developed to their full, explosive fury, firefighters may have as much as several hours to analyze their risk and decide what to do to maximize suppression effectiveness.

No matter what course of action firefighters choose, their decisions are not usually final because they must base their decisions on information that is incomplete. In addition, information deteriorates quickly with time.

Safety Zones

A basic element of fire suppression safety is a safety zone, a place where firefighters are free from danger, risk, or injury. It is vital that firefighters know where and how to get to areas that provide a safe refuge when they analyze risk. In any given tactical operation, firefighters must identify or create safety zones and "escape routes" that provide access to them. For operational assignments that require extensive and lengthy fireline construction, firefighters must develop a network of safety zones and escape routes. How is this network designed? What factors should be considered?

The safety zone and escape route network must be an integral part of tactical fireline operations, not added as an afterthought or after a fireline is constructed. All fireline construction should start from a safe anchor point. As fireline construction proceeds from that safe point, safety zones are identified or constructed along the way. Any time firefighters venture beyond the safety zones, they are at risk. As the distance between the firefighter and the safety zone increases, so does the risk of entrapment or burnover.

Risk Threshold

At some distance from the safety zone, firefighters begin to feel uncomfortable about their position. This discomfort may result from increased fire activity or the threat of increased fire activity. They realize that there may be insufficient time to successfully retreat to the safety zone should the need arise.

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Mark Beighley is the team leader for Resource Operations, USDA Forest Service, Deschutes National Forest, Bend and Fort Rock Ranger Districts, Bend, OR.

They have reached their risk threshold—that point at which the level of risk is too high. To reduce the level of risk, firefighters must then reduce the distance to a previous safety zone or locate or create a new safety zone.

The risk threshold for all firefighters is different. Every firefighter possesses a different combination of knowledge and experience with which to evaluate the relative safety of the current situation. Firefighters may also have different information regarding local factors that might affect fire behavior.

There is an assumption that veteran firefighters have well-defined, accurate risk thresholds. Also, it is assumed that these risk thresholds can be depended upon to provide a consistent and appropriate assessment of safety for any given tactical fireline operation. But even if firefighters have developed accurate risk thresholds, they always have a degree of uncertainty because of inadequate or deteriorating information. Because conditions on a fire seldom stay constant for more than a few hours and can change quite rapidly, a constant supply of information is an important facet of the risk assessment process.

When Safe Becomes Unsafe

Risk threshold applications are, fortunately, rarely tested. Even when firefighters are uncomfortable with their position, the fire does not always test the situation. Feedback on risk threshold is infrequent; therefore the accuracy of a firefighter's risk threshold is often unknown. Even under the best of circumstances, the most experienced and knowledgable firefighters are plagued with imperfections inherent in the human condition. Inattention, distraction, fatigue, attitude, boredom, information overload, mind set, and carbon monoxide poisoning can all work to erode the judgment of the most vigilant of firefighters.

Safe becomes unsafe when the fire has the potential to get to the firefighter before the firefighter can get to a safety zone. That philosophical break-even point is the line between safe and unsafe fireline operations. The firefighter must constantly evaluate where that line is and how close he or she is to it, given the current situation. Uncertainty is always present. Risk threshold is not measurable, therefore not quantifiable. Firefighters cannot measure how close they are to an unsafe situation. Only the fire can provide feedback to the accuracy of their risk threshold.

Quantifying Fireline Safety

Without the ability to measure the safety of their position, firefighters will not consistently know when a safe situation becomes unsafe. What is safe in the morning could become unsafe in the afternoon. What is safe about their current position could become unsafe as they continue to build fireline.

In order to assure safe fireline operations, firefighters need processes to evaluate fireline safety that are measurable, consistent, and transferable. When they can measure how safe they are, firefighters can repeat that safety measurement and communicate it to others. They will be able to describe what is safe and unsafe and evaluate the safety of their current and planned actions.

Two distance and time relationships must be evaluated by firefighters before they can determine how safe they are. The first is the distance between the fire and the safety zone and the time (T1) it would take the fire to spread to the safety zone. The second is the distance between the firefighter and the closest safety zone and the time (T2) it would take for the firefighter to retreat to it. Knowing these two times will allow the firefighter to determine where the line between a safe and unsafe operation exists. For example, in figure 1, the firefighters estimate that it will take 18 minutes (T1) for the fire to reach the safety zone and 12 minutes (T2) for them to reach the zone.

Creating a Margin of Safety

A margin of safety can be described as a cushion of time in excess of the time needed by the firefighters to get to the safety zone before the fire gets to them. It is the positive difference of T1 - T2. In figure 1, the difference is 6 minutes (18 minutes - 12 minutes), so the firefighters are in a safe position. If T1 = T2 as in figure 2, the difference is 0 and the fire and firefighters arrive at the safety zone at approximately the same time. Obviously, this situation would not benefit the firefighters; the fire may block their planned escape route. At best, they would experience a very close call, so they need to evaluate their margin of safety for escape or build a new safety zone.

If the difference is less than 0 as in figure 3 (T1 is 12 minutes and T2 is 15 minutes equalling -3 minutes), then it is likely that the fire will reach the firefighters before they get to the safety zone. While we would hope that firefighters would deploy fire shelters and survive the

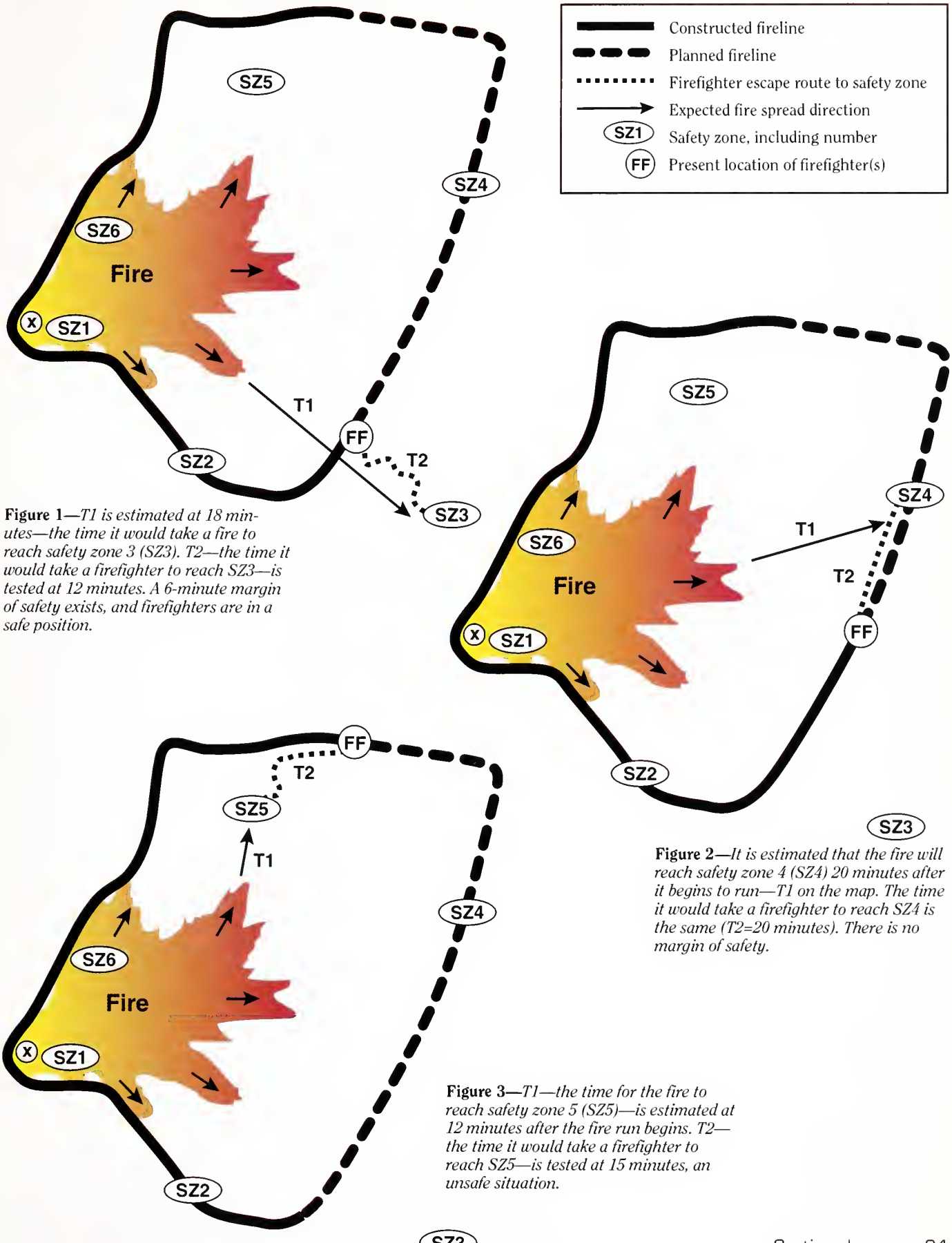

Figure 1—*T1 is estimated at 18 minutes—the time it would take a fire to reach safety zone 3 (SZ3). T2—the time it would take a firefighter to reach SZ3—is tested at 12 minutes. A 6-minute margin of safety exists, and firefighters are in a safe position.*

Figure 2—*It is estimated that the fire will reach safety zone 4 (SZ4) 20 minutes after it begins to run—T1 on the map. The time it would take a firefighter to reach SZ4 is the same (T2=20 minutes). There is no margin of safety.*

Figure 3—*T1—the time for the fire to reach safety zone 5 (SZ5)—is estimated at 12 minutes after the fire run begins. T2—the time it would take a firefighter to reach SZ5—is tested at 15 minutes, an unsafe situation.*

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fire, for a margin of safety, firefighters must arrive at the safety zone before the fire. T2 must be less than T1. In this example, the firefighters need to locate or construct a closer safety zone, abandon their suppression effort, or the fire behavior characteristics need to change. In short, the greater the positive difference between T1 and T2, the greater the margin of safety.

Firefighters should increase their margin of safety when there is an increase in uncertainty. Uncertainty can come from many situations. Firefighters can be uncertain about future weather conditions, a specific fire location, expected fire behavior in local fuel types, their own and others' physical ability, and the effectiveness of control actions on adjacent divisions or other fires in the immediate area. Firefighters must consider these variables when managing a margin of safety. There should never be any uncertainty about the location of safety zones and escape routes, the adequacy of communications, or the posting of lookouts.

Firefighters can use the T1 and T2 concept to provide a measurable, consistent, and transferable process to assess their margin of safety. This will enhance the value of L.C.E.S. applications—Lookouts, Communications, Escape Routes, and Safety Zones. Firefighters will be able to identify when "safe" will become "unsafe" and communicate that to all affected personnel. They will know when to look for new safety zones and when escape route travel times are too long.

For large fire operational planning, this assessment can be conducted prior to committing firefighters to a fireline assignment. Safety zone and escape route requirements can be identified in the Incident Action Plan. A network of safety zones and escape routes can then be developed in conjunction with fireline construction. Firefighters will be able to create and maintain a margin of safety when they are beyond the safety zone. ■

USDA Forest Service Firefighters at Camp Pendleton

Maryjane Cavaioli

The USDA Forest Service holds a Fire School annually on the Camp Pendleton Marine Corps Base near Oceanside, CA, in cooperation with the camp's own civilian fire department. Firefighters from the Angeles, Cleveland, and San Bernardino National Forests were among the 1,000 individuals who attended the school during the last week of May and the first week of June in 1995. All engine crews, hotshot crews, and helicopter crews from the forests attended. In addition to the Camp Pendleton Fire Department, other agencies participating were the Federal Fire San Diego Area (a consolidated Federal fire agency in the Department of the Navy), USDI Bureau of Indian Affairs, and fire departments from local municipalities.

Maryjane Cavaioli is a public affairs specialist for the USDA Forest Service, Inyo National Forest, Mt. Whitney Ranger Station, Lone Pine, CA.

An Incident Management Team from the three forests managed the school. Joint Incident Commanders were Hal Mortier for the Cleveland, Rich Hawkins for the Angeles, and George Motshall for the San Bernardino National Forest. Chief Robert Praytor directs the Camp Pendleton Fire Department.

The participants had a base camp at Camp DeLuz, a training area in Camp Pendleton, complete with command trailers, bulletin boards, and tents for overnight camping, and ate their meals at the Marine Corps dining hall.

There were four 2-day sessions, each attended by approximately 250 people, who had already had the basic 32 hours of training or its equivalent. Each session included 1 afternoon and 1 full day of live fire training. New supervisors and potential supervisors led their crews in fire situations to gain experience as leaders.

In addition to wildland fire exercises in chaparral and scrub oak vegetation, firefighters extinguished several automobile fires to practice using self-contained breathing apparatus. Forest Service Helicopter 540 from the Cleveland National Forest participated in the suppression activities, and in case additional forces were needed, a Camp Pendleton brush engine stood by.

Surprisingly, many of the firefighters who attended this Fire School had the opportunity to use their new skills within a month of their training. There were several wildland fires in southern California and in Arizona in June. ■

Africanized Honey Bees: A New Challenge for Fire Managers

Laura D. Merrill and P. Kirk Visscher

Firefighters face a new hazard—Africanized honey bees. However, knowledge and preparation can reduce the risk posed by these newcomers to American wildlands. Africanized honey bees (AHB) and the familiar European honey bees (EHB) are freely interbreeding subspecies of *Apis mellifera*. The most obvious differences between AHB and EHB are behavioral: AHB defend their nest much more vigorously. Moreover, AHB are ecologically adapted for life in tropical ecosystems in their foraging, nesting, and reproductive behavior, while EHB are adapted to a temperate climate.

Early concern about the stinging behavior of Africanized bees stimulated extensive research, including efforts to genetically dilute or otherwise arrest the migration of AHB in Latin America. Although these programs enhanced our knowledge and ability to deal with the bee, its migration has not been stopped. The similarity of AHB and EHB makes it impossible to eradicate one and not the other, and honey bees are essential to agriculture as pollinators. Education is the key to successful coexistence, although bee breeding and bee management changes will also play a role.

Laura D. Merrill is an entomologist for the USDA Forest Service, Forest Pest Management, San Bernardino, CA, and P. Kirk Visscher is an assistant professor for the Department of Entomology, University of California, Riverside, CA.

Wildland firefighters are facing a new hazard—highly defensive Africanized honey bees.

Firefighters and others accustomed to dealing with EHB are not prepared for the extreme defensive behavior of AHB. If firefighters disturb an AHB colony, thousands of bees may attack them within a few minutes. This creates a particularly dangerous situation when the victim is unable to escape the bees (for example, if the victim is on a ladder or is rock-climbing), when the victim is a child or elderly person (and so less tolerant of bee stings than a young adult), or if the victim is dangerously allergic to bee venom. Firefighters need to be educated about AHB both for their own protection and because they may have to help rescue a victim.

Honey Bee Biology

Geographical Distribution. Honey bees are not native to the United States but were imported by European settlers for honey production.

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Feral European honey bee nest in a hollow pine in Florida. Guard bees cluster around the nest entrance as foragers return with nectar, pollen, and water. Photo: P. Kirk Visscher, University of California, Department of Entomology, Riverside, CA, 1988.

In 1956, African honey bee queens were introduced into Brazil to breed bees better adapted to the tropics. The African genotype has since spread at a rate of 100 to 300 miles per year (160 to 480 km/yr). AHB have not spread south of Buenos Aires, but the eventual northern limits of their range are unknown. AHB were found in the lower Rio Grande Valley of Texas in October 1990 and have since spread across much of south and west Texas, southern Arizona, and parts of southern New Mexico. In 1994, AHB were found to be widely distributed in Puerto Rico, and on October 24, 1994, a swarm of AHB was found near Blythe, CA. AHB have since colonized portions of the southwestern California counties of Imperial and Riverside.

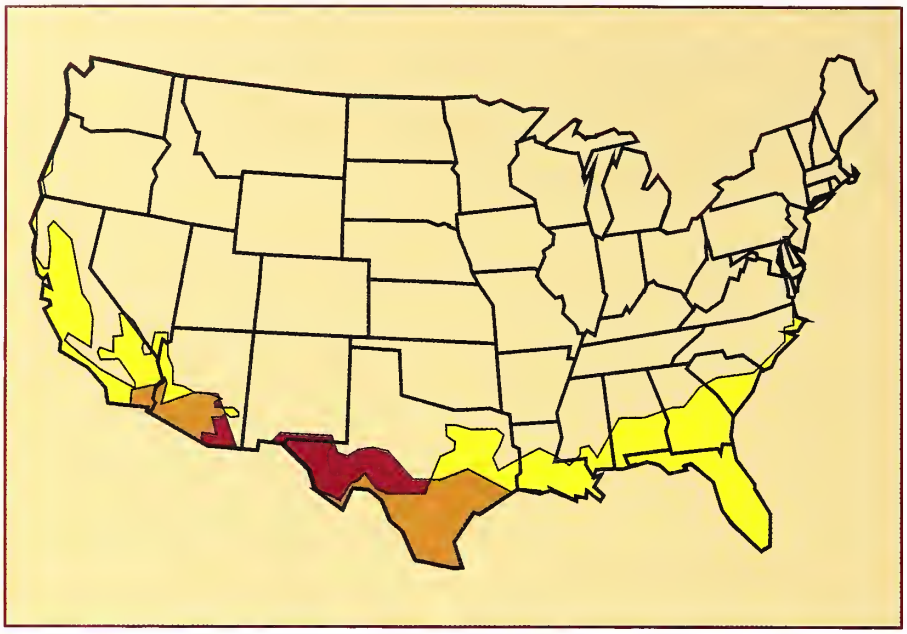

Figure 1—*By August 1995, Africanized honey bees (AHB) colonized the area of the United States shown in red and orange on this map. The area in yellow (and orange where it overlaps AHB distribution) is the limit of the 240-day growing season, one of several projections of the eventual distribution of AHB.*

Figure 1 shows the distribution of AHB in the United States in August 1995 and the 240-day growing season limit. The latter is one estimate of AHB's eventual distribution. There is disagreement among experts on AHB's future spread. AHB are partially limited by cold: they are far less selective than EHB in nesting sites, even nesting in the open, and do not store as much honey as EHB; thus AHB cannot survive for as long periods (e.g., 3 months) without nectar. In the tropics, AHB are found in elevations up to 8,900 feet (2,700 m) (Taylor 1988); thus summer invasions of mountains adjacent to Africanized areas in the United States may be expected. Ultimately AHB spread is likely to be limited by competition with temperate-adapted EHB more than by climatic factors alone, and the edges of the colonized areas will be marked by zones of hybridization between the two types of bee. Hybridization in Texas has already made it difficult to characterize a given colony as AHB or EHB, and this pattern seems likely to be repeated as the AHB genotype spreads in the United States.

Biology. Honey bees live in colonies of 10,000 to 50,000 individuals, consisting of a queen, sterile female workers, male drones, and developing bees. A colony increases in size during the growing season and splits into two or more colonies. A queen and group of workers leave the nest all at once, often landing on a nearby tree while scout bees seek a new nesting site. Swarms are most common in spring and early summer, but may occur at other times, particularly with AHB. AHB differ from EHB in producing more swarms per year (6 to 8 versus 1 to 3 per colony). Also, AHB swarms may fly much further before establishing a new nest and are often smaller than EHB swarms. Swarming bees are **usually** engorged with honey and unlikely to sting.

It is the stinging behavior of AHB that interests most of us. AHB respond rapidly and in large numbers to disturbances that EHB would ignore. Like EHB, AHB can sting only once; they deliver a venom identical to that of EHB. Both types of bee die shortly after leaving their stings in their victim. However, stinging by either type of bee also leaves a chemical marker, or alarm pheromone, on the victim. This pheromone is also released in the air by the extruded sting of a disturbed bee.

Hybridization with EHB has been suggested as a method of gentling AHB. Experience in Mexico and Brazil suggests that hybrid bees are more manageable than AHB, but research on the defensive behavior of hybrids has produced variable results.

Bees and Fire. How AHB react to wildfires will have to be determined empirically, but there is no reason to expect that fire will make them more aggressive. Smoke has

a calming effect on honeybees and interferes with their sense of smell, making them less likely to respond to alarm pheromones (Visscher et al. 1995b).

Firefighter Safety

Bee Awareness. Fire crews unfamiliar with AHB need to be trained in AHB safety. Avoiding bee colonies is the best defense. It is not possible to distinguish Africanized from European bees in the field. Therefore in areas that might have AHB, any feral nest should be treated with suspicion and left alone. Unfortunately, colonies are often hard to spot. Bees entering and exiting a hole are a good indication of the presence of a nest. AHB will nest in hollow trees, in cavities or animal burrows in the ground, in buildings (particularly in wall voids), and in debris. Where other nest sites are not available, AHB will nest in dense vegetation where the light is reduced. One survey in the Panama Canal area showed that about 75 percent of nests were located in buildings and cavities made by people, so particular care should be taken around these (Roubik 1991). In arid regions, honey bee colonies are likely to be more common near water sources.

When possible, the use of noisy, vibrating equipment such as chain saws and augers should be avoided in the vicinity of bee colonies. AHB may be incited to attack by such disturbances as far as 100 feet (30 meters) away. If bees are nesting near the ground, they will easily encounter people and human activities will disturb them more easily. Even nests high off the ground sometimes respond to people as a threat.

A swarm of honey bees on a branch. Photo: P. Kirk Visscher, University of California, Department of Entomology, Riverside, CA, 1988.

Crew supervisors and safety officers need to be aware of bee hazards and plan escape routes for crews fighting fires in areas where AHB are known or suspected to be a problem. Medical unit leaders need to be prepared to treat and, if necessary, evacuate victims of bee stings.

What To Do if Attacked. In a fire situation, extensive surveying for bee colonies is impractical, and the best one can do is prepare to respond to stinging if it should occur. In most situations, the best response is to get away from the site of the nest as fast as possible; in other words, **run**. Run away from the nest if you know its location, but if you don't, it's probably best to retreat the way you came. Bees are more likely to pursue you if they can see you clearly, so retreating through shrubbery can be useful, but not if it slows your retreat. Covering your head, especially your hair, with a jacket or shirt will reduce the number of stings you receive and may reduce disorientation as long as you can still see well enough to escape quickly. Swatting at the bees will

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cause them to be more upset. Although AHB are reported to pursue intruders for up to 1/4 mile (400 m), few new bees join the attack once the intruder leaves the immediate vicinity of the nest. The number of attacking bees drops off sharply with distance. If possible, get inside a building or vehicle quickly. Some bees may follow you in, but not usually enough to be a serious threat.

Protective Equipment and Chemicals. Personnel who will be dealing with bees regularly should have protective clothing. The single most important item of equipment is an inexpensive bee veil. Bees prefer to attack the face and head, which is disorienting. Military surplus insect headnets will work when worn over a hat to keep the fabric away from the scalp.

To be impenetrable to stings, clothing must be either very tough (leather) or very thick (1/8 inch or 3 mm). However, smooth finished and light-colored fabrics (including Nomex) do not attract as many stings as dark, fuzzy fabric or exposed skin, and can offer significant protection even if thin. Nomex worn over a second layer of clothing will offer additional protection. Attacking bees may get into clothing at the neckline, ankle, wrists, and other openings. Tucking shirts into pants and securing cuffs with duct tape or by tucking into boots will help reduce stinging. Plastic hazardous materials suits are inexpensive; the slick plastic material is difficult for the bees to grip. Bee suits cost $35 and up; they should be purchased by any district dealing with feral bees on a regular basis.

Blankets, fire shelters, and so forth can be used to reduce the number of stings if the victim cannot immediately escape. As when retreating to a vehicle or building, the few bees which may be trapped under the blanket will not be a significant hazard. The usefulness of fire shelters for protection from bees is currently being tested by Dr. P. Kirk Visscher.

A young honey bee worker on a comb. Photo: P. Kirk Visscher, University of California, Department of Entomology, Riverside, CA, 1988.

Insect repellants applied in advance of an attack will not deter attacking bees. DEET, a common ingredient in insect repellents, will deter bees if it is sprayed **during** an attack, but only while the victim sprays the DEET into the air. DEET is unlikely to be of practical value in most firefighting situations.

Treating Stings. When honey bees sting, the sting remains in the victim with the venom sac attached. The sting continues to pump venom into the victim for several minutes. Therefore it is very helpful to remove the stings as quickly as possible. Stings may be scraped off or plucked out. Although it is usually advised that pinching the venom sac will squeeze more venom into the victim, recent experiments suggest that the method of removal is not important, while the speed of removal is (Visscher and Vetter in review). In multiple stinging incidents, count the stings to assist emergency room physicians with estimating venom dose. If the victim has been stung more than 15 times, has difficulty breathing, displays other evidence of a systemic reaction, or is allergic (even if a bee sting kit is used), the victim should receive medical attention. Self-monitoring of reactions to bee stings is risky. The median lethal dose (LD50) for bee stings is 8.6 stings per pound of body weight (19 stings/kg). For example, the median lethal dose for a 150-pound (67.5-kg) individual is 1,290 stings. Adult victims receiving many hundred stings have survived with medical attention.

Victim Rescue

The goal of the first responder should be to assist the victim (get the victim away from the bees and to a hospital) while avoiding being stung or having the bees sting bystanders. The appropriate response

depends on the situation—whether the victim is mobile, whether other potential victims are nearby, whether the first responder is allergic to bee stings, and whether the attack occurs where trained help is available. No one who is allergic to bee stings should attempt a rescue. If a vehicle is available, the first responder should get into it and call the victim towards them. The victim may be disoriented and need directional assistance (e.g., "Run this way"). If the victim is incapacitated and still under attack, do not attempt a rescue or get within 200 yards (180 m) of the attacking bees or their nest without protective gear. If the victim is down and the first responder has protective gear, cover the victim with a blanket to prevent further stinging until the victim can be removed from the site. Keep bystanders away from the area to prevent further attacks. Firefighters with water trucks available can use a mist of "wet water" to knock the attacking bees out of the air (Erickson and Estes 1992). (Plain water is rapidly shed by the bees' waxy cuticle, but water with surfactant clings to their wings, preventing flight, and clogs their breathing pores.) Surfactants such as liquid dishwashing detergents, non-foaming fire control chemicals, and firefighting foams with surfactant characteristics (e.g., aqueous film-forming foams (AFFF)) are effective.

If the victim cannot be immediately evacuated, assistance should be aimed at the following:

- Prevent further stinging by covering the victim and, if possible, by removing the victim from the vicinity of the attacking bees.
- Remove all stings.
- Use first aid ABC (maintain airway, breathing, and circulation).
- Treat for shock.

Massive bee stings cause swelling of the tissues of the neck, leading to difficulty in breathing. In allergic patients blood pressure drops because of histamine release, leading to cardiac arrest. CPR should be initiated if necessary. If the victim is allergic and carries injectable epinephrine, it should be administered within a few minutes with the help of a trained assistant. Antihistamines (particularly Benadryl) are helpful in all patients. Epinephrine inhalers **may** be of some use, but are not a substitute for injectable epinephrine. Any analgesic available (aspirin, Tylenol) may be used. Certified emergency aid personnel should receive special training in treatment of victims of multiple bee stings. **Field treatment is not a substitute for hospitalization, and the victim should be evacuated as soon as possible.** The 6 to 12 hours following an attack can be critical.

Management of AHB Around Fire Stations and Other High-Use Areas

Since bees sting in large numbers solely to defend their nests, management around high-use areas should be directed at preventing nesting. In areas where AHB occur, an employee should be assigned to monitor buildings, debris, and other potential nest sites weekly for bee activity. If a nest is found, management may choose to hire a pest control operator or use a trained employee to destroy the bees. Because of liability risks, contracting out bee control work may be more economical. A nuisance-bee manual that includes specific pest control recommendations is in preparation for Federal land managers (Williams et al. in review). Within the zone populated by AHB, feral bee colonies in high-use areas should be destroyed regardless of whether they are of European or African origin. Unmanaged EHB colonies may become Africanized, and even EHB colonies may present a stinging hazard.

Before locating incident command posts and fire camps, the area should be surveyed for bees. In some areas, campgrounds will be surveyed as part of normal management, and thus these may be good locations for fire camps from the bee safety perspective. Feral honey bees found nesting within 200 yards (180 m) of a fire camp should be killed.

After a colony of bees is killed, wax comb, honey stores, and dead bees remain in the cavity. When the nest is in a building these materials can decay, damaging floors and walls and producing objectionable odors. Swarms of bees will be likely to reoccupy the cavity, attracted by odors that may remain for many years. For these reasons, simply killing the bees is not enough. If possible, the nest cavity should be exposed, all nest material removed, and the cavity should be filled up with insulation (so it cannot be reoccupied) and resealed. This procedure is expensive and sometimes impossible if the wall cannot be opened. If the nest cannot be removed, care should be taken to seal or screen all possible entrances to the cavity so bees cannot reenter. However, **never** seal the outside entrance if there are live bees in the nest. They may find other means of emerging from the wall—sometimes inside the building. If the nest is in a hollow tree, the opening may be screened over or the cavity filled with concrete or expanding foam to prevent reuse.

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It is usually easier to prevent bees establishing nests in a structure than to remove them once established. "Bee proofing" involves sealing or screening with 1/8 inch (3 mm) or less mesh all cracks and holes that lead into wall voids, attics, or other cavities. It is also wise to remove debris that may provide attractive cavities (e.g., empty drums, water tanks, abandoned vehicles, flower pots, old tires).

It is much easier to kill a small, recently established colony than a larger, older one. Vigilance in monitoring for bee nests in developed sites will pay off in ease of control. The longer a colony is in place, the more wax and honey are accumulated and the more defensive the bees may become.

Swarms in transit to a new homesite usually pose little threat of stinging, and depart within 24-48 hours. If the swarm is still present 24 hours later, it may be advisable to destroy it. If the swarm must be destroyed, soapy water can be used to drown the bees (Visscher et al. 1995a). M-Pede is the pesticidal soap registered for such use in California. A tarp should be used under the swarm to collect the dying bees so they can be removed from the site. Some living bees will return to the swarm site and may cause problems. They can be trapped with a recently developed pheromone-baited trap (Visscher and Khan 1995) or treated with soapy water after sunset, when they have returned to the site. Although swarms are **generally** docile, control should not be attempted without proper protective gear. The area should be cleared of people and domestic animals. In some areas, county mosquito abatement districts or other government agencies will kill swarms. In some cases, it may be advisable to contract out swarm control to licensed pest control operators.

One experimental method of bee management is to saturate a particular area with bait hives on the theory that with the appropriate chemical attractants in the bait, the bees will choose those hives to colonize rather than nesting in buildings or hollow trees. The bait hives must be monitored every 2 weeks, and occupied hives must be removed and destroyed. This method is being used in the Caribbean National Forest in an attempt to protect the nesting area of an endangered parrot. The efficacy of this method has not been proven, and the cost may outweigh the benefits in most situations.

Resources

In California, county agricultural commissioners have taken the lead in AHB management and education and can provide the names of pest control operators trained in honey bee control. In other States, contact the State department of agriculture.

Training is available on AHB, victim rescue, and swarm and nest abatement. Training videos include 10- to 15-minute films with general information on AHB and more technical videos on destroying swarms and nests. Written materials include informational leaflets, fact sheets, and many nontechnical and technical articles on AHB. Various government agencies have developed training for urban firefighters on victim rescue. For a list of available videos, bee equipment suppliers, and other information, contact Laura Merrill, San Bernardino National Forest, tel. 909-884-6634, ext. 3199; DG: L.Merrill:R05F12A, internet: / s=l.merrill/ou1=r05f12a@mhs-fswa.attmail.com.

Conclusions

AHB do pose a new threat in outdoor areas. This threat can be minimized with awareness of the potential problem and preparation through training and equipment. While firefighters should be aware of the risks and be prepared to respond, the problem should not be blown out of proportion. We can coexist with these new arrivals.

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Safety First: Brain vs. Brawn

Nancy Lee Wilson

In my years as a firefighter, I've been through numerous "briefings," both as the person needing the information and the person giving it. I've learned there are five "W's" and an "H" that must be answered before accepting an assignment. These questions are why?, where?, what?, when?, how?, and who? I've used these questions here to share what I've learned about firefighting safety during the past two decades.

WHY? Purpose for Writing

My first year as a helitack crew member for the USDA Forest Service on the Umatilla National Forest in Oregon was a long time ago—in 1976. When I was part of fireline production, I was in the top third of the crew in speed and efficiency, but I was always in the bottom third in running proficiency. By 1991 when I joined the Asheville Hotshots in the Southern Region, I could still sustain line production, but every day I was last in running.

Over 15 years, I had changed a lot in the way I perceived myself, so my pride was not bruised from always being last. I had learned that it is not great strength and physical ability that *keep* a good firefighter safe. It's the ability to observe and communicate the fire environment to one's colleagues, and it's knowing how much can be accomplished under current and predicted parameters with the forces on hand. To put it simply, when it's brain vs. brawn, the safest firefighters use their brain!

Nancy Lee Wilson is a fuels operation officer, USDA Forest Service, Deschutes National Forest, Crescent Ranger District, Crescent, OR.

Author Nancy Wilson, having just returned from underburning on the Crescent Ranger District, says, "...When each of us uses our brain, we are a stronger, safer firefighting organization." Photo: Shannon Cooper, USDA Forest Service, Deschutes National Forest, 1995.

WHERE? Uncertainties During Transitions

Each fire is different. I've never experienced two wildfires that are alike. And even though one of our 10 Standard Fire Orders is "Obtain current information on fire status," unfortunately, many times all the information about a particular fire is not available. This seems particularly true when I've been part of a crew sent to a fire as an off-district or off-forest resource. In my experience, the weakest safety link has often been the sharing of information during the transition when additional forces arrive (the second or third day of a fire).

District resources and personnel are being stretched to and beyond their limits. Not only is there a decline in the numbers of personnel, but we have lost a great deal of knowledge that once was passed down from those more experienced in firefighting. We all know that Government downsizing and retirements have had a definite impact on each unit's effectiveness. In addition, when fuels accumulate in the forests over time and we experience the effects of 6 years of drought, we especially miss those who have gone and taken their knowledge with them. Those of us who are left must pass on what we have learned to those who depend on us for our acquired knowledge and information.

WHAT? Beginning To Learn

I believe that one factor in a firefighter's use of unsafe practices is that we haven't always been committed to talk about and reinforce the principles of fire behavior. The 10 Standard Fire Orders and 18 Situations that shout "Watch Out!" were developed because of what we have learned in the past about how fires behave.

Too often we send young, ambitious individuals to "fire school" and expect them to understand the importance of the orders and the situations. Yet for many, it's their first summer in a forest. They must wait 5 to 10 years to get intermediate fire behavior (S-290) or higher level training. They know

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that they are expected to produce so many chains of line. Do they always know **why** they must learn how to avoid getting caught off guard when fire conditions change?

WHEN and HOW? Time Commitment

Probably some firefighters say to themselves, "This is only a summer job." Because they assume they will not be firefighters for very long, they think they don't have to pay close attention to fire behavior. Perhaps they feel they don't have to know why they must follow the fire orders.

Shouldn't fire behavior be a part of our normal work conversation? When it is, those who have a wealth of information can share what they have gleaned through the years. We can explain how to evaluate fuel conditions, what the effects of local weather patterns are, and where the local topography is unique. We can present safety scenarios, give younger firefighters "What if?" situations to help them make decisions under pressure. Even going through the examples in the *Firefighters Guide* (NWCG 1986) could be part of each day's morning briefing tasks for those who will be first response forces to a wildfire.

WHO? Mutual Efforts

It can't be said often enough—safety is everyone's responsibility. If we want our young firefighters to learn, those of us with more experience must be there for them. We must communicate. All of us must ask questions, get answers, repeat back what we hear, and write it down when necessary. Among the things we must teach is that while brawn is essential to enduring extreme conditions under which we work, when each of us uses our brain, we are a stronger, safer firefighting organization.

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Fran Retires, April Arrives

Neale A. Shultz

Regular readers of *Fire Management Notes* (*FMN*) will notice a new name on the masthead under the title of general manager. Francis R. Russ, who held that title since 1980, retired in July. While Fran spent many hours on FMN, his primary responsibility in Washington, DC, was as the Federal Excess Personal Property (FEPP) management specialist for Fire and Aviation Management. April Baily, formerly a FEPP manager on the Procurement and Property Staff in Washington, became *FMN* general manager and FEPP program manager in September 1995.

Neale A. Shultz is a volunteer for the USDA Forest Service, North Central Forest Experiment Station, East Lansing, MI. She was assistant editor and an intern for Fire Management Notes *from August through December 1995.*

Fran's knowledge about the agency and Federal property made him a reliable source of information on a variety of fire management topics, and he contributed a number of articles to *FMN* over the years. Throughout his tenure as general manager, Fran promoted the original purposes of the journal. *FMN* has remained "...a medium of exchange of information and ideas between all the groups who are doing creative work in forest fire [management]" as well as "a carrier" of what both fire managers and those in the field needed to know (Headley 1936).

In addition to his sharing of knowledge, Fran is well known for his friendly demeanor and sense of humor. Whether conversing on the telephone or greeting visitors in the WO, Fran knew what it is to be a USDA Forest Service "HOST" and always gave first-rate customer service.

Fran Russ, former general manager of FMN, outstanding in the field of Federal Excess Personal Property. Photo: USDA Forest Service, Washington DC.

Fran and his wife, Inez, have retired to Littleton, NC, and plan to spend a lot of time on the water. "Noah is building the boat," Fran said recently. We'll miss Fran but wish him and Inez a very happy retirement. We also heartily welcome our new general manager; we're very glad that April's arrived.

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Firefighters Can Protect Themselves Against Blood-Borne Infections[1]

Richard J. Mangan

FOREST SERVICE TECHNOLOGY & DEVELOPMENT PROGRAM

All firefighters know the dangers inherent in suppressing wildland fires. Cuts from tools, fractures from trips and falls, and illness from heat and physical exertion are just a few examples. Because firefighters are regularly at risk of injury (often in remote areas), they are trained as first responders. It is essential that each firefighter be able to provide immediate care to an injured coworker.

However, in recent years, a serious new concern for first responders has arisen. They now risk contracting blood-borne infections from Hepatitis B Virus (HBV), Human Immunodeficiency Virus (HIV), and other pathogens. According to an OSHA Fact Sheet, about 8,700 health care workers each year are infected with HBV, and 200 die from the infection. There are "universal precautions" that first responders can take to prevent infection. If they know the correct techniques for handling infected biohazard materials and laundering Nomex fire clothing possibly infected with HBV or HIV, they can prevent contact with a patient's blood and certain other body fluids.

Dick Mangan is fire program leader for Fire and Aviation Management, USDA Forest Service, Missoula Technology and Development Center, Missoula, MT.

[1]This article, in part, was first published as Fire Tech Tip #9451-2353, "Handling Bio-hazard Material," by the Missoula Technology & Development Center in September 1994.

> Firefighters can take "universal precautions" to prevent blood-borne infection while treating the injured as first responders.

Personal Protective Equipment (PPE) to reduce potential infection from blood-borne pathogens includes gloves, gowns, face shields, and pocket masks. These PPE items are available as part of standard type I through IV first aid kits as well as in stand-alone body fluid barrier kits (National Fire Equipment Systems #0640). The kits also contain biohazard waste bags. The use of PPE combined with proper disposal of contaminated materials in these bags will greatly reduce the chance of the care-giver becoming infected.

Gloves Are Essential PPE

Gloves must be worn whenever treating an injured person and when handling clothing or other items that may be contaminated with blood or body fluids. If there is any question about the adequacy of a pair of gloves to provide protection, a second pair of gloves can be worn over the first pair. Gloves should be left on, not only when treating an injured person, but also when handling clothing, bandaging material, or other items that may have been contaminated. After finishing with treatment and

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Gloves must be worn when treating an injured person and when handling contaminated items. Photo: Dick Mangan, USDA Forest Service, Missoula, MT, 1994.

disposal of contaminated material, gloves should be removed by grasping one of them at the cuff and pulling it inside out over the fingers. When the first glove is removed, place it in the other gloved hand. Then remove the second glove, using the same process as before. This technique will enclose both gloves and keep any contaminant from touching bare skin.

Single-use gloves provided in first aid or body fluid barrier kits should not be washed or decontaminated for reuse. Place them in a properly designated biohazard container ("the red bag") for disposal.

Handling Biohazard Material Safely

Although most gloves and the other PPE contained in the body fluids barrier kit are disposable, not all items contaminated with blood or body fluids are intended for disposal after use. However, all items must receive special handling until they are properly decontaminated or disposed of as regulated waste in accordance with State and local laws. You can obtain specific information on disposal from your local hospital or emergency care facility. When in the field or on the fireline, place contaminated items in the red plastic biohazard waste bags found with the body fluid barrier kits and first aid kits. Obtain additional bags for fires and other incidents from the supply unit or medical unit.

Biohazard waste bags containing contaminated material should receive special handling, especially in areas like an incident base camp. All individuals who handle the bags should be aware of their contents and should know proper handling and disposal techniques.

Laundering Contaminated Nomex

Low-cost items such as T-shirts or forest worker gloves can be disposed of after contamination with blood or body fluids. However, since Nomex Aramid fire shirts and jeans are both expensive and relatively easy to decontaminate, such articles should be thrown away only after gross contamination.

Contaminated Nomex Aramid clothing that will not be laundered within 12-24 hours should be air-dried in sunlight prior to placing it in a biohazard waste "red bag." Even after air drying, those who launder these items should wear gloves and launder the items separately from other soiled laundry.

If Nomex Aramid clothing will be laundered within 12-24 hours of contamination, immediately place in a biohazard waste bag. Photo: Dick Mangan, USDA Forest Service, Missoula, MT, 1994.

The protective qualities of Nomex Aramid fibers are not affected by normal laundry practices, but **don't use bleach** since it degrades the resistance of Nomex and may break open in entrapment conditions. Dupont, the manufacturer of the Nomex fiber, recommends laundering contaminated items in cold water with any commercially available laundry soap or detergent that does not contain bleach. Hot water washes Nomex better than cold water, but colors fade more quickly in hot water than in cold water washes.

Exception To PPE Use

There is only one exception to the need for using PPE to protect against possible infection from blood and body fluids. First responders may choose temporarily and briefly and under rare and extraordinary circumstances to forgo using PPE if they believe that its use would prevent the delivery of necessary care to an injured individual. **Exceptions should be extremely limited.**

When unprotected individuals are exposed to blood or body fluids, they should report that exposure to their local or agency safety officer as soon as possible. Early action is crucial, since immediate intervention can forestall the development of Hepatitis B or enable the affected person to track potential HIV infection. It also can help avoid spreading a blood-borne infection to family members and coworkers.

For additional information on blood-borne infections, preventive techniques, or what to do if exposed, contact your local health office. ■

Lessons Learned From the South Canyon Fire: Fire Safety, A Community Effort

Paul Orozco and Daniel J. Jiron

"We hope by this report that we are raising the caution sign and when necessary, the stop sign. . . . We further ask you to provide the leadership needed to give an extra margin of safety in all that we do and prevent a reoccurrence . . ."
—Mark A. Reimers, Deputy Chief, Programs and Legislation, USDA Forest Service, August 1994, Denver, CO.

On July 2, 1994, at a time of low humidity, record-high temperatures, and drought, lightning ignited a fire 7 miles (11 km) west of Glenwood Springs, CO. According to the investigation report, "In its early stages, the fire burned in the pinyon-juniper fuel type and was thought to have little potential for spread." This fire on Storm King Mountain and the events that followed resulted in the tragic deaths of 14 firefighters and forever altered the lives of survivors and the entire wildland firefighting community.

As soon as possible after the incident occurred, the South Canyon Interagency Investigation Team was formed to investigate what had gone wrong. After this team completed their investigation report, a National Interagency Management Review Team formulated a corrective actions plan. It is important that we look at their findings to determine lessons that must be learned and corrective actions that the fire management community must take so that we never again experience a tragedy such as the one that occurred at South Canyon on July 6, 1994.

Paul Orozco is a fire management officer and Daniel J. Jiron is a district ranger for the USDA Forest Service, Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands, Pueblo, CO, and Fairplay, CO, respectively.

> "There is a dire need to create a passion for compliance with the basics of safe fire suppression."
> —South Canyon Fire Accident Investigation Team 1994

Fire Safety—a Collaborative Approach

After the South Canyon fire fatalities, USDI Bureau of Land Management Director Mike Dombeck said, "There is only one way to fight fire without risk, and that is not to fight fire at all." Wildland firefighting is an essential part of natural resource management, especially where urban areas move closer to wildland areas and population increases. The investigation finding that continues to get attention is "There is a dire need to create a passion for compliance with the basics of safe fire suppression." Firefighting will always include risk, but the South Canyon experience and others have reminded the fire management community of the need to create and maintain an environment where a passion for safety exists. Everyone at all levels of the interagency firefighting force needs to use a collaborative approach to account for fire safety.

What is a collaborative approach? Currently, interagency fire management has several levels of accountability. Each one of these levels must act interdependently to ensure that safety is as ingrained in firefighting as the "can do" attitude that has saved lives, property, and natural resources in the past. We must also do more to reach people outside the fire management community.

Initially, the first priority for people directly involved in fire suppression is to create an environment that promotes safety. There are different management levels within each fire suppression incident, and each level has varying degrees of accountability for fire safety. A review of the South Canyon Fire investigation illustrates these levels of management and accountability.

The investigation team used the "Fire Entrapment Investigation and Review Guidelines," developed by the National Wildland Coordinating Group and included in appendix 12 of the South Canyon

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report (South Canyon Fire Accident Investigation Team 1994). Following these guidelines, the team analyzed how 27 categories of events contributed to the accident on the South Canyon Fire with the assessments "significantly contributed," "influenced," or "did not contribute." It is within these 27 categories that different management levels have various degrees of accountability for fire safety.

Clearly, management levels on the fire and fireline—Incident Commander or fire leadership and firefighters—are the most accountable for fire safety. In fact, they were directly accountable for 19 of the 27 categories of findings that contributed to the South Canyon accident. However, fire management officers, dispatchers, and line officers also share in the accountability for fire safety within these contributing categories of findings. These findings reinforce the notion that safety and accountability must exist at all levels of the fire organization.

For example, while a number of categories such as fuels, weather, and topography (significant contributors to the accident) would primarily be accountable to positions on the fireline, fire management officers and dispatchers can help provide information that would result in more informed decisionmaking for firefighters.

Those on the fireline need all the help they can get, especially in threshold fire behavior conditions such as in 1994. Recognition of these conditions by fire management and line officers is key in delivering support to fireline personnel to ensure fire safety. All of us must continue to struggle with recognizing threshold conditions on every unit, every year, to meet the safety needs for fireline personnel.

The South Canyon Interagency Investigation Team reviewing the charred slopes of Storm King Mountain where on July 6, 1994, 14 firefighters lost their lives. Photo: Jim Kautz, USDA Forest Service, Missoula Technology and Development Center, Missoula, MT.

Fire Safety—Opportunities for Support

Opportunities to improve firefighter safety are open to all levels of the fire management community. Line officers must seek opportunities to "walk in the shoes" of the firefighter to develop an awareness of what is critically important in maintaining fire safety. Line officers and fire management must exercise responsibility to support fire safety by developing information processes to inform firefighters of threshold fire behavior and/or conditions contributing to incident complexity. In addition, line officers and fire management must support hiring procedures that will enhance the agency's ability to maintain experienced seasonal fire personnel.

Dispatch procedures need to be continually assessed and improved to take full advantage of technology that provides better fire behavior potential such as red flag conditions, the Haines' Index, Palmer Drought indices, and upswings in the energy release component.

Fire Safety—Recognizing the Mission

It doesn't seem possible for an experienced fire management officer to be unaware of fire safety needs in the field. However, the reality is that many of us in the fire management community are often surprised at the changing mission in fire suppression and the new technologies that are available. Some members of the fire community are not aware of the simple fire safety needs of today's fireline personnel.

It is important for line officers and fire management to recognize the potential for conflict and then provide for management that addresses changing missions, provides adequate training to complete the mission, and does not use firefighters in situations for which they are inadequately prepared (be accountable).

A good example of the changing mission in fire suppression is the disparity among fire management officers and their feelings about interagency hotshot crews (IHC) being used for initial attack. Some hold the view that hotshot crews should be used only as large fire reinforcements, while others say the IHC's fire suppression mission is to assist with all fire suppression, including initial attack.

Individuals Have Championed Safety

Paul Gleason, of the Arapaho-Roosevelt National Forests in the Rocky Mountain Region, has long championed fireline safety, initially as a hotshot superintendent and now as a district fire management officer. His work with Lookout(s), Communication(s), Escape Route(s), and Safety Zone(s) (L.C.E.S.) and correct methods for entering the fire environment plus his analysis of fireline decisionmaking continue to be leading contributions to fireline safety.

Others, including Mark Linane (Los Padres IHC superintendent), are also continually analyzing and developing fireline safety needs such as guidelines and tactics to mitigate hazards (e.g., midday fire operational start ups, downhill and indirect line, and helicopter delivery above the fire). These types of efforts need to occur on a continual development and assessment basis by everyone, especially personnel who spend the majority of their on-the-job time on the fireline.

Fire Safety—Organizational Shifts

In light of changing programs and organizations, we must assess experience and participation in fire management at all levels to ensure fire safety is not compromised. A lack of experience and participation in fire management can easily result in leadership that cannot provide sound and clear fire safety leadership. Agency downsizing, fire management officers with collateral duties and skills, a lack of experience, and more emphasis on fire program management may also result in leadership that must overcome additional challenges to provide sound and clear fire safety leadership.

Safety Outreach

The fire management community at all levels must also externally carry the message of safety and the benefits of safety to the public and our partners. In light of increasing populations and more complex wildland-urban interface issues, the fire management community cannot afford to raise awareness internally only. We must take a proactive approach in working with local and State governments. We must be involved in planning for future growth, not only with local firefighters but also with county planners, elected officials, and economic development entities.

All of these individuals and entities will directly influence our ability to meet the fire suppression demands of the future and the safety pressures these demands will place on our personnel. State and local governments and citizens must know how high the stakes are and that times have changed in wildland firefighting. South Canyon has proven that a deadly fire does not have to be in a remote location, but can be within sight of a city.

How can the fire management community carry the message of safety, strategy and tactics, and the need for a greater awareness of fire suppression activities and planning to local and State governments as well as citizens? The fire management community must forge a strong relationship with line officers and managers and public affairs officers in the agencies.

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There must be a concerted effort away from looking at public affairs as a fire information activity at an incident or simply as a tool to manage media interest in suppression activities. This alliance between line officers and managers, public affairs officers, and the fire management community must be raised to new levels of awareness and cooperation to meet these internal and external objectives. We need to enhance expertise and understanding of external relations by Incident Commanders. Discussions of firefighter safety should be a paramount topic at all future incidents and in external relation efforts, especially in terms of accountability for fire safety by all involved.

Still others will need to be involved; social scientists at all levels must work with us in developing effective and meaningful ways to connect urbanization and population issues directly to suppression efforts and impacts on safety.

Fire safety should not be an issue that the average citizen hears about only when a fatality occurs, but it should become a part of everyone's life—particularly for those who live in wildland-urban interfaces and depend on the fire management community for the protection of their lives and property.

These are ambitious steps. They will require that the fire management community begin to work and communicate with each other, with agency personnel not involved in fire, and with society in a new way. If we are truly to institutionalize a passion for safety, then it must be done from the standpoint of an interdependent approach, internally and externally. It will require that people involved with fire step out of their internal fire management community role more often and take what they know to the rest of society.

When tragedies occur such as the South Canyon fatalities and the other tragedies of 1994, we vow that we will learn from them and improve in the future. Progress has already been made, and we must take credit for the gains we have made in safety. In any given year, we have thousands of firefighters in the field with good safety records.

Summary

Let us vow to continue to study the 1994 fire season to ensure our vigilance in applying the lessons learned. We must continue to pursue improved communication and build trust with each other and society to address the challenges that we face through collaboration and partnership. As Edmund Burke said, "Society is a partnership in all science, a partnership in all art, a partnership in every virtue and in all perfection. As the ends of such a partnership cannot be obtained in many generations, it becomes a partnership not only between those who are living, but between those who are living, those who are dead, and those who are to be born."

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Update on Face and Neck Shrouds[1]

Kevin Lee

In a continuing effort to improve firefighter safety, the Missoula Technology and Development Center (MTDC) has studied the problems of providing face and neck protection from radiant heat without compromising work performance. Researchers at the University of Montana's Human Performance Laboratory extensively tested face and neck shrouds and balaclava-style hoods (alone and with a respirator). They found that detachable face and neck shrouds provided the best protection without causing firefighters undue discomfort or heat stress.

Many models in use are equipped with hook and pile fasteners (Velcro), which allow the firefighter to attach the shroud quickly to the back and sides of a hardhat that also has the Velcro strips. Once the shroud is attached, the firefighter can easily secure the shroud around the throat and lower face. Hardhats that don't already have the Velcro strips can be retrofitted—at least one hardhat manufacturer sells a kit for this purpose. When firefighters have an easily detachable shroud, they can remove it when they don't need it and reattach it when necessary in a few seconds.

Kevin Lee is a forestry technician for the USDA Forest Service, Missoula Technology and Development Center, Missoula, MT.

[1]This article, in part, was first published as "Face/Neck Shroud" in the June 1994 issue of *Fire Tech Tips*, published by the USDA Forest Service's Technology and Development Program, Missoula, MT.

A Note of Caution. Firefighters using the shrouds might increase their exposure to radiant heat because they can approach and remain closer to fires than they can without this equipment. In addition, the ability to remain in areas of intense heat puts firefighters at risk due to the operating failure of personal protective equipment such as protective goggles, hardhats, and webbing or packs made of polypropylene. Some of this equipment is constructed of plastics that soften at 300 °F (149 °C).

These observations of equipment failure serve to point out one important consideration about the use of the face and neck shroud: it is intended to give the firefighter added protection when leaving situations that suddenly occur (e.g., flareups) or getting past areas of intense heat. It is not intended to be used by the firefighter to approach and remain in areas of high radiant heat.

MTDC recommends firefighters routinely carry shrouds in their pockets or packs, rather than attached to their hardhats. This not only allows maximal head cooling; it also keeps the face uncovered. Exposed skin is the firefighter's best indicator that radiant heat is reaching potentially hazardous levels. When sudden, unavoidable conditions cause a level of exposure that exceeds normal situations, the shroud can be quickly attached to give added protection to the firefighters.

A firefighter demonstrates how to wear a face and neck shroud for protection when near areas of intense heat for short periods. Photo: Dick Mangan, USDA Forest Service, MTDC, Missoula, MT, 1994.

MTDC further recommends that individual wildland fire agencies set specific directions for use of face and neck shrouds by their employees. Shrouds are discussed in the National Fire Protection Association (NFPA) Standard 1977, "Protective Clothing and Equipment for Wildland Firefighters." Agencies procuring shrouds may wish to consider this standard before making purchases.

Readers with questions about face and neck shrouds or who want to know what features to look for when purchasing ear, neck, and face protection should contact Ted Putnam, MTDC, Bldg. 1, Ft. Missoula, Missoula, MT 59801 or telephone 406-329-3965. Electronic mailing address is FSWA/S=T.Putnam/OU=R01A@ATTMAIL.COM. and, for Data General users, R01A. Fax is 406-329-3719. ■

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